SHOUT
SHARE
IT

Station
Bulletin
418

Report of the Director

OF THE

New Hampshire Agricultural Experiment Station

UNIVERSITY OF NEW HAMPSHIRE
DURHAM, NEW HAMPSHIRE

COVER: Professor Ford S. Prince first came to the University of New Hampshire in 1913 as Instructor and Assistant Professor of Agronomy. He returned to his native State of Ohio from 1918 to 1925. Since 1925 he has been engaged in teaching, research, and extension work at the University. After nearly thirty-five years of productive scientific effort and association with farmers of the State, Professor Prince is still actively working in Agronomy as Agronomoist in the Experiment Station and in the Cooperative Extension Service.

APRIL 1955

REPORT OF THE DIRECTOR

OF THE

New Hampshire Agricultural Experiment Station

July 1, 1953, to June 30, 1954

UNIVERSITY OF NEW HAMPSHIRE
DURHAM, NEW HAMPSHIRE

Foreword

This bulletin represents the 66th annual report of the Director of the New Hampshire Agricultural Experiment Station, an integral part of the College of Agriculture at the University of New Hampshire. The progress reports for the formal research projects were prepared by the respective project leaders. They are grouped by departments and not necessarily by subject matter in all instances. The diverse nature of New Hampshire's agriculture is occasion for research in many areas.

In the United States today the number of farms and the number of people living on farms is declining, and yet the total population of the country is increasing rapidly. Only about fourteen percent of the total population now lives on farms. In other words, fewer and fewer farmers are producing the food and fiber for more and more people. This is progress. No country in the world today can enjoy even a modest standard of living and at the same time maintain an increasingly larger proportion of its population on farms. Again in the United States, food is of higher quality and is more plentiful today than ever before. Moreover, an industrial worker can buy more food with an hour of work than at any time in history. This is evidence of a healthier and more comfortable living for all segments of our society.

Agricultural research has contributed much to this economic progress. The impact on all the people represents the dividends on a public investment. Surely, it is only through research that society can be assured of an adequate supply of good quality food at a reasonable cost. Research in agriculture has therefore been supported largely by public funds, both Federal and State. It was never intended that producers alone should reap the benefits from agricultural research. The beneficiary is our entire society.

Each state has one or more agricultural experiment stations which are supported by both Federal and State funds. In nearly all states, the funds are direct appropriations. For the United States as a whole the experiment stations are expending more than five dollars of state money for each dollar of Federal appropriations. In four small states, including New Hampshire, considerably less than one half of the expenditures are derived from State funds.

The New Hampshire station has outgrown its facilities. A spacious Agricultural Sciences building is badly needed to replace the present Dairy Building and to house other departments, thereby relieving the crowded conditions found in nearly all units of the station. A Home Economics building must be forthcoming if this department is to conduct a modest research program in addition to its teaching obligations. Forestry is in a somewhat similar situation. Poultry disease work and dairy nutrition research are handicapped by space limitations, as are Chemistry, Economics, Agronomy, Botany, and Horticulture.

A review of the progress reports contained herein will evidence an increasing attention toward investigations of fundamental

laws and principles. Applied research, however, continues as the major part of the station's program.

Society gains from its investment in agricultural research only as the results of that research are made available to those who are in a position to apply them. It is particularly important that these results be made available through publications and the Cooperative Extension Service, to producers and also to research workers at other experiment stations. This matter of communication is of great concern and will be partially resolved by publishing the results of applied research in the form of a periodical of some three or four issues per year. This new publication will receive general distribution among farmers. Moreover, it will replace the progress reports of the Director's annual report. The bulletin series of the experiment station will continue, and the results of the more basic research will continue to be published in professional journals.

HAROLD C. GRINNELL
Director

MATHIAS C. RICHARDS
Associate Director

Contents

Page

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

The Carbohydrates in Pasture Grasses 7
Effect of D-Amino Acids on Growth of Lactobacilli 7
Chemical Studies Concerning the Determination of Ascorbic Acid in Foods 7
Work with Lime and Chelated Compounds on a Paxton Soil in the Greenhouse 8
Lasting Effect of an Application of Lime and Cobalt to a Gloucester Soil 8
Carotene Content of Grass and Clover Ensiled with Different Preservatives 9
Other Active Projects 9

AGRICULTURAL ECONOMICS

Tank-Truck Assembly of Milk in New Hampshire 9
The Population of New Hampshire — Basic Trends and Characteristics 10
A Description and Analysis of the Livestock Markets Available to New Hampshire Dairymen and Beef Producers 11
The Economics of Dairy Herd Replacements 11
Marketing Mixed Grain Feed 12
Production Management Problems on Specialized Poultry Farms 13
Costs and Efficiency in Marketing Poultry Products 13
Effects of Reservoir Construction on the Agricultural Economy of the Merrimack River Valley 13
Agricultural Damages, Reach 8, Merrimack River, 1936 Flood 14
Other Active Projects 15

AGRONOMY

"Merrimac", a New Potato Variety 15
Search Continued for a Perennial Red Clover 15
Better Adapted and Higher Yielding Corn and Grain Varieties 15
Radioactive Phosphorus Absorption by Potato Leaves Shows that Phosphorus Fertilizer Can be Applied as a Foliage Spray 16
Potato Scab Easier to Prevent Than to Cure 17
Legume-Grass Yields Highest Without Nitrogen Fertilizer 17
Narragansett Alfalfa Proves Superior 17
Breeding of Grasses and Legumes in the Search for Superior Plants 18
Irrigation Water and Nitrogen Fertilizer Can Be Wasted 19
Lime Makes Potash More Efficient 19
Birdsfoot Trefoil a Superior Legume on Soils of Low Fertility 19
Root Habits Can Be Changed 19
Other Active Projects 20

BACTERIOLOGY

Diagnosis and Control of Vibriosis in New Hampshire Dairy Herds 20
Studies on Bovine Mastitis 20

BOTANY

New Blight-Resistant Tomatoes Show Promise 20
Propagation of Woody Plants 21

New Organic Fungicides Show Promise for Disease Control Under New Hampshire Conditions 21
Virus Diseases of Strawberries in New Hampshire 21
Effective Materials and Methods for Composting Sawdust and Other Wood Wastes 21
The Flora of New Hampshire 22
New or Unusual Diseases in New Hampshire 22
Other Active Projects 22

DAIRY HUSBANDRY

New Method of Determining Gross Energy and Protein in Plant Materials Shows that Silage Excells Comparable Hay in Nutritive Value 22
Methane Production Uniform in Ruminants Fed Roughages 23
The Excretion of Vitamin B_{12} by Cows 23
Vending Machines Increase Use of Fluid Milk 23
More Extensive Use of Grass Silage for Dairy Calves and Heifers. 24
Bisulfate Applicator Can Be Made from Corn Planter 25
The Value of Balsam Fir as Food for Deer 26
Vitamin Synthesis in the Rumen of Deer 26
The Relation of Seminal Fluid Fructose Levels to Factors Affecting Breeding Efficiency 26
Low Trace Mineral Content of Feed Does Not Appear to Adversely Affect Reproduction in Dairy Cows 27
Other Active Projects 27

ENTOMOLOGY

Testing New Organic Insecticides under New Hampshire Conditions 27
Factors Affecting the Action of Acaricides 28

FORESTRY

Soil-Yield Relationships of White Pine in Southern New Hampshire 28
Marketing Forest Products Is an Important Phase of the Agricultural Economy of New Hampshire 29
The Utilization of Products from Chemically Treated Trees 29
Results of an Investigation of the Variable Plot Method of Cruising Timber 29
Other Active Projects 30

HOME ECONOMICS

Human Nutrition Research 30

HORTICULTURE

Effect of Hay Mulch and Minerals on Yield of Northern Spy Apples.... 31
Sources of Magnesium for Apple Trees 31
Annual Cropping Northern Spy Apple Trees Are High Yielders 31
Fruit Trees for Northern New Hampshire 31
New Red Horticultural Bean Variety Named Scarlet Beauty 32
Korean Shrubs Are Ornamental and Attractive to Wildlife 32
Hybrid Chestnuts Resulting from Crossing Two Known Species 33
Superior Snap Bean Named Green Crop 33
New Hampshire Red Pickler Tomato 33
Chemical Weed Control Makes More Effective Fertilization in Low Bush Blueberry Fields 33

Weed Killing Chemicals Are Essential in Reclaiming Blueberry Land 33
New Raspberry Variety Named New Hampshire 34
Do We Have a Virus in Our Apple Rootstocks? 34
The Occurrence of Over-Coloring and Blotching in Apples on Double Worked Apple Trees 34
Malus Sikkimensis as an Understock for Semi-Dwarfed Apple Trees 35
A New Wick Watering Method for Potted Plants 35
Introducing Monarda "Granite Pink" 35
Two Late Lilac Varieties Named 36
Progress in Breeding Rambler Roses for Cold Climates 36
Aluminum Foil Appears to Speed Healing of Wounds on Tree Trunks 37
Conserving Soil Moisture 37
The Testing and Utilization of New Plants 37

POULTRY HUSBANDRY

Breeding for Whiter Dominant-White Crossbreeds 37
Growth Rate of Durham X New Hampshire Crosses 38
Breeds and Strains of Chickens Differ in Amount of Yellow Pigment Present in the Shanks During the Growing Period 38
Selection of Poultry for Better Feed Utilization Efficiency 38
Good Poultry Ranges Can Lower Pullet Rearing Costs 39
Methionine and Methionine Hydroxy Analogue May Improve Broiler Feeds 39
Mass Immunization of Chickens Against Newcastle Disease and Infectious Bronchitis 39
Early Wing Web Vaccination for the Prevention of Newcastle Disease 40
No Detrimental Effect to Chickens from Nitrophenide Fed During Their Entire Period of Growth 41
Conditions Under Which Hatching Eggs Are Held Influence Quality of Chicks 42
Abnormal (Bulging) Eye in New Hampshires 42
Influence of Light and Humidity Upon the Physical Condition of Broilers 42

STATE SERVICES

Inspection of Fertilizers and Feedingstuffs 43
Seed Inspection, 1953-1954 43
Soil Testing, 1953-1954 43
Diagnostic Services Performed at the Poultry Laboratory, University of New Hampshire 44
Infectious Bronchitis Virus 44
Pullorum Testing 44

ADDENDA

New Hampshire Agricultural Experiment Station Staff 45
Changes in Personnel 47
Publications 48
Scientific Contributions 48
Research Mimeographs 48
Financial Statement 49

Agricultural and Biological Chemistry

The Carbohydrates in Pasture Grasses

The results of investigations made in cooperation with the U. S. Regional Pasture Research Laboratory at Pennsylvania State University, dealing with chemical changes in grasses as they mature, can be summarized as follows:

Eight grasses common to the Northeastern United States were grown in small plots at State College, Pennsylvania, and analyzed for their major organic constituents, particularly for the carbohydrates. Analyses were made on samples taken during the spring months when the grasses were normally cut for silage or hay. All of the grasses during this period of time underwent continuous decreases in protein, acid-soluble ash, and ether extract, and showed a continuous increase in lignin. All varieties showed an increase in crude fiber and in true cellulose and natural cellulose up to the flowering stage and in some grasses up to the seed-dough stage. In some, fiber decreased after the flowering stage. On the basis of changes in lignin and fiber, lignin is perferred over fiber as a criterion of feeding value. Highly significant positive correlations were found among lignin, cellulose, and fiber, and among protein, ether extract, and acid-soluble ash; significant negative correlations were found between the constituents of the two groups. On the basis of chemical composition alone, grasses high in feeding quality appear to be, in order, reed canarygrass, Alta fescue, and Kentucky bluegrass; of low relative quality were timothy and red top; intermediate were bromegrass, orchardgrass, and tall oatgrass.

In the second part of the project, chemical changes in grades in successive cuttings at pasture stage were studied. The chemical analyses have been completed and the results are being prepared for publication.

T. G. Phillips

Effect of D-Amino Acids on Growth of Lactobacilli

Some D-amino acids, when present in relatively high concentration, repress growth of various lactobacilli. In some cases, the L-forms of these amino acids cause a similar, but more moderate, repression, indicating that these D-amino acids do not act as antimetabolites for the L-forms. That the effect is not permanent is indicated by the fact that repressions were obtained only when the incubation period was relatively short. This suggests a possible conversion of the D- to the L-form before utilization.

A. E. Teeri

Chemical Studies Concerning the Determination of Ascorbic Acid in Foods

Results obtained during breeding trials to develop a high vitamin C tomato variety have been compiled. The studies reveal the presence of an enzyme in the parent plant, but not in all the progeny. The enzyme is capable of destroying ascorbic acid, and its presence (or absence) must be taken into consideration in breeding work carried out to obtain tomato varieties with high Vitamin C content.

Factors of importance which influence the determination of the amount of ascorbic acid in frozen and stored strawberries were found as follows: (1) the presence of a high sugar content, (2) changes due to hydrolysis of carbohydrates during storage, and (3) presence of varying amounts of dicarboxylic acids as noted by changes in total titratable acids and pH. These factors must be taken into account when analyzing for the ascorbic acid content of foods commonly accepted as rich sources of this vitamin.

S. R. Shimer

Work With Lime and Chelated Compounds on a Paxton Soil in the Greenhouse

Oat plants were grown in pots in the greenhouse at two levels of soil fertility and with variable amounts of lime. Chelated compounds were added to the pots with the low level fertility soil. These pots had received the equivalent of ½ ton of fertilizer and 2 tons of lime per acre. At both the higher and lower levels of fertilizer, significant decreases at the 1 percent level occurred where the two tons of lime equivalent had been applied. None of the chelated compounds gave significant yield differences at the 1 percent level, but applications of zinc and copper together gave significant increases at the 5 percent level.

In a later test, corn was grown in the same soil and pots after the soil was refertilized to the low and high fertility levels. There was an increase in corn yields with the addition of lime up to 1½ ton equivalent in the low fertility soil and up to 1 ton of lime in the high fertility soil. Additions of lime in both cases beyond these amounts decreased yields. With equivalent lime applications, there was a decrease in pH with higher fertilizer applications.

Effect of Fertilizer Soil Application on pH

	No Lime Added To Soil	Equivalent 1 Ton Lime Per Acre pH	Equivalent 2 Tons Lime Per Acre
Equivalent 1000 lbs. of 5-10-10 per acre	5.19	5.90	6.39
Equivalent 2000 lbs. of 5-10-10 per acre	5.04	5.65	6.16

G. P. Percival

Lasting Effect of an Application of Lime and Cobalt to a Gloucester Soil

The pH values of soil samples taken at 2 inch levels from plots on Gloucester soil showed that 5 years after application the effect of the 1 ton of lime had penetrated 4 inches and that of the 3 ton application, 6 inches.

When an additional 50 pounds of nitrogen from nitrate of soda was applied annually to the lime plots over and above the annual basic addition of 15 pounds of nitrogen, the pH values increased at the upper levels as well as at a greater depth.

Analyses of the forage samples taken from these same plots show that while both 2 pound and 5 pound applications of cobalt were effective in in-

creasing the cobalt content of timothy, only the 5 pound application increased it well above the adequate requirement.

Nitrogen restricted the uptake of added cobalt. Lime and nitrogen each restricted the uptake of manganese; when applied together, they reduced the manganese content to about 1/3 of that found in the untreated plant.

G. P. Percival

Carotene Content of Grass and Clover Ensiled with Different Preservatives

Fifty-five gallon oil drums painted inside with rubber-base paint and lined with Sisalcraft paper were used in tests to compare various methods of preserving silage. Weighed forage samples were placed in the middle of each drum in Lumite plastic-screen cloth bags. The content of each drum was weighted with sand to approximate silage conditions.

A cutting predominantly of grass was preserved with sodium bisulfite, and a cutting predominantly of red clover was treated with sodium bisulfite, dried stabilized molasses, and calcium formate. A check sample without preservative was also ensiled.

The loss of carotene from the original samples was used to determine the value of the treatment. Sodium bisulfite proved to be a very satisfactory preservative, and dried stabilized molasses was next in value, closely followed by the untreated sample. There was considerable loss of carotene in the silage treated with calcium formate.

All of the materials used were easier to handle than sulfur dioxide gas or liquid molasses. In all of the test treatments the silage had a good odor.

G. P. Percival

OTHER ACTIVE PROJECTS

Prevention of Discoloration of Pre-Peeled Raw Potatoes

W. A. Averill

Soluble Substances in Grass and Legume Silages

T. G. Phillips

Agricultural Economics

Tank-Truck Assembly of Milk in New Hampshire

Competition for the sale of milk and milk products necessitates that every endeavor be made to reduce the costs of production, processing, and distribution. The introduction of farm bulk tanks and tank-truck collection is a move in this direction.

This study poses the problem created by numerous small farms and dealers in New Hampshire and estimates the costs and savings for producers, assemblers, and dealers. The choice of the right size of tank or tank-truck in relation to potential production is a major determinant of cost. Herd expansion must meet the problem of markets at a time when milk production per cow and per herd is creating surplus milk problems in New England.

A large number of small producers in New Hampshire will delay the introduction of farm-tank assembly so that a 100 percent conversion cannot be expected in the near future. Its adoption is symptomatic of the economies of scale, however, and strengthens the pressure for more efficient milk production and marketing from larger operating units at lower costs.

J. R. Bowring

The Population of New Hampshire — Basic Trends and Characteristics

This is the forerunner of further studies on population with particular emphasis on the rural-urban migration and the meaning of such migration to rural institutions and communities. Characteristic of most rural areas in the United States, technological progress in agricultural production is reducing the number of people required on farms to provide the nation's food supplies. Industrial employment opportunities have provided the vehicle for movement out of agriculture, especially since 1940. Such shifts create sociological problems in rural areas and in the urban areas to which people have moved. It is opportune, therefore, that such problems be studied and analyzed to enable individuals and government better to appreciate the adjustments and to aid in the transition.

There has been a steady increase in the population of New Hampshire since the turn of the century. The rate of increase has been relatively low compared with some of the western states and even with the southern New England states. However, the increase continues at a rate similar to the neighboring State of Maine.

The northern counties of New Hampshire have not increased at as great a rate as such southern counties as Strafford and Rockingham. There has evidently been a larger emmigration from the northern counties. In common with the United States, the rural-farm population of New Hampshire continues to decline. In contrast the rural-nonfarm population is increasing.

Canada is still the major national origin of the foreign born residents of the state, but the relative number of foreign born to native born has declined steadily for the past four decades.

The birth rate of New Hampshire residents is increasing and the number of children born to females between the ages of 20 and 34 compares more than favorably with the United States average. Marriage rates were greatly accelerated during the 1940's.

The education of New Hampshire people, or at least the number of years they have attended school, has increased so that the current proportion of urban and rural dwellers who have attended high school compares very favorably with other states. There is a noticeable increase in the schooling of younger age groups.

Age-sex data indicate males and females are more evenly distributed in the urban population than in the farm population, where there is some preponderance of males. The exodus of both males and females from farms to urban centers occurs at the highest rate around the age of 20. There is a growing proportion of older people in this state, but otherwise the age distribution is not different from the rest of the country.

A net cash income from $2,000 to $4,000 is the most common per family in New Hampshire. This includes all earnings of members of each

family. There is a somewhat lower proportion in the higher income groups than for the United States, but net cash incomes below $2,000 per year are less common in New Hampshire than for the nation as a whole.

J. R. Bowring

A Description and Analysis of the Livestock Markets Available to New Hampshire Dairymen and Beef Producers

There is active trading in livestock in New Hampshire. The sale of cull cows, dairy herd replacement cattle, and a few hogs and sheep justifies the existence of numerous small packing houses and custom slaughterers in the state. In addition, licensed dealers trade in livestock and buy from farmers to sell on local or out-of-state markets.

This study describes the size and location of dealers and packers and discusses the market process. It shows the influence of the Brighton market on local prices and the influence of Chicago price in New England. The majority of hogs and sheep sold are custom slaughtered and the cull cows or beef cattle are in general slaughtered by the packers in New Hampshire and Massachusetts.

The price that producers receive from dealers is based on the dealers' expected sale price. Market news from Brighton is published once a week only, so that there are chances of inter-week price changes which may be known by a dealer actively selling on the market but not known by the producer. Independent selling by farmers reduces their bargaining position.

The predominance of meat and livestock shipments into New England from western sources limits the extent to which livestock sales either for slaughter or for dairy herd replacement can become more profitable. Within this national price framework, certain economies of assembly by consolidation of loads might be possible; producers also might organize into a bargaining cooperative to protect individual farmers not familiar with market price changes and to protect buyers against diseased and low producers.

The competitive nature of the industry, however, relates prices in New England to prices in other livestock producing areas. Prevention of price fluctuations or short-run price declines not justified by long-run market demand and supply for meat are therefore national problems best solved at that level.

J. R. Bowring

The Economics of Dairy Herd Replacements

Detailed farm management records from a sample of New Hampshire dairy farms have been summarized. About 40 percent of the farms visited purchased no dairy replacements. The remaining 60 percent of the farms purchased from one to all of the replacements necessary to maintain the dairy herd. Many factors influence the replacement program, but the belief that the quality of home-raised replacements is superior to purchased replacements seems to be of primary importance in farmers' considerations.

For herds which are primarily milk suppliers rather than combined breeding stock and milk producers, there seem to be opportunities for profitably purchasing replacement stock of good quality. Herd life, one of the important considerations in comparing purchased and raised replacements, does not seem to be significantly different for raised and purchased cows, based on a summary of cow removal records for the New Hampshire Dairy

Herd Improvement Association and individual farmers. However, the problem of a replacement program is related to many factors peculiar to the individual farm. The relative prices of young stock, dairy replacements, beef, and milk are important when considering the profitability of purchasing versus raising replacements. Many of these factors are now being considered in order to provide New Hampshire dairymen with a complete analysis of the opportunities to increase farm income through selling or purchasing dairy replacements.

W. F. Henry

Marketing Mixed Grain Feed

Mixed grain feed is the principal cash cost in poultry and dairy production. In addition, feeding constitutes a major share of chore time on poultry farms. Effecting economies in the distribution of grain feeds and in farm feeding practices assume increasing significance in times of declining farm prices and surplus production.

It is apparent from data obtained from feed dealers that distribution costs can be reduced, even with the present market arrangements. This can be accomplished through such things as rearrangement of delivery routes, use of labor-saving equipment, and minimization of route delays. Increased cooperation between dealers and farmers could eliminate many delays and inefficiencies on the farm.

Bulk feed, while clearly advantageous to many farmers, poses difficult cost problems for many dealers. Duplicate plant facilities and delivery equipment are often involved. The "potential market" for bulk feed varies from area to area and in accordance with such factors as farm unit size, driveway conditions, company policies, and frequency of delivery. Its expansion is also limited by demonstrated economies in railroad vs. long-haul truck costs.

Feeding grain to dairy cattle constitutes a minor share of chore time, but any savings would come at a period of the day when demands upon worker's time are heavy. Bulk feed might effect minor time savings. Mechanical feeding of grain to dairy cattle is just progressing beyond the experimental stage and is not yet used in New Hampshire.

Significant operating economies can be achieved by poultrymen through use of auxiliary equipment in flock feeding. For example, where feed rooms were located on each floor but feed was carried to pens in pails, 2.7 man minutes daily were required to feed 100 layers. Use of bulk feed bins spouting into automatic feeders made it possible to cut daily feeding time to 0.5 minutes per 100 layers. Bulk handling of feed as such may not greatly reduce the labor required in feeding. The installation of feeding equipment results in more significant time savings than a change to bulk handling.

However, bulk handling in most cases has certain advantages that should be considered:

1. The cost of feed in bulk, including bin cost, is lower than in bags.
2. Lifting of feed is reduced or eliminated.
3. Bulk handling can be combined with automatic or carrier feeding with considerable ease and with significant time savings resulting.

G. B. Rogers

Production Management Problems on Specialized Poultry Farms

There have been a number of significant changes in the scope, structure, organization, and seasonal aspects of the New Hampshire poultry industry in recent years. No comprehensive poultry management study has been carried out at this Experiment Station since 1929-30. With increasing specialization in eggs or poultry meat, the problems of management differ from those in earlier years. Information is needed on such matters as economies of scale, the effects of combining labor and capital in various proportions, some of the advantages and disadvantages of various alternative enterprises and combinations thereof, as well as an appraisal of the magnitude and direction of changes in the industry.

Some preliminary work was carried out during the year which would enable rapid progress in this study, should it be reactivated. This involved re-drafting field questionnaires, pre-testing these forms, assembling data from secondary sources, revising field questionnaires, and selecting a sample of poultry farms for study. It was decided to concentrate initially on poultry farms specializing in market and/or hatching eggs. The sample of about 30 farms was selected to include both part-time and full-time operations, and various unit sizes.

G. B. Rogers

Costs and Efficiency in Marketing Poultry Products

The production of poultry meat has become a very important source of income to New Hampshire poultry farmers in the past 12 years. Since 1940 poultry meat production has increased fourfold. Changes in the marketing system both as to kind and quantity of services offered have also occurred. It is evident that this system, at present, possesses areas of inefficiency, and that in some cases the resources involved are not being used fully. If the poultry meat industry in this state is to develop further, it must meet the competition for markets from producers in other areas, and its ability to do this will depend to a large extent upon the economy with which its products are marketed.

This research is concerned with discovering the problem areas in poultry meat marketing and with finding ways to improve efficiency. Preliminary results indicate that most of the broilers are marketed through an integrated system which is relatively efficient, but that the fowl, coming from many widely scattered and often small farms, is marketed largely through many small handlers. Whether improvements can be made in this area will be determined by this study.

W. F. Henry

Effects of Reservoir Construction on the Agricultural Economy of the Merrimack River Valley

Future development of dry reservoirs for flood control is planned in New Hampshire and other states. Various governmental agencies, farmers, utility companies, and industrial firms are anxious to determine the benefits and costs of such construction. Since farmers are primarily concerned with the land acquisition in the reservoir sites, and are also benefited by reduced flood danger in the valley below the dam, this study of the effect of reservoir construction on agriculture is being made as an aid and guide to the farmer.

A preliminary report has been made for the area of the Merrimack River Valley between Manchester and Nashua, New Hampshire. Since the agriculture of the whole valley is heterogeneous, it is not possible to expand the analysis for the Manchester section to the whole river. The rest of the study will be completed soon.

Damages of several types occur from flooding agricultural land. The greater part of these are associated with land and crops on the land, but some damages occur to buildings and livestock. Of the damages to land, some are immediate in that growing crops are effected in some way, some are of short-run effect to the land causing temporary loss of crop yields, and some are of long-run effect in that land is lost permanently for agricultural purposes or crop yields are permanently reduced.

For the Manchester-Nashua section of the Merrimack River, 7¼ miles of the 116 mile length of the river, the flood damages in the 1936 floods are summarized in the following table. These figures are taken from the actual experiences of farmers obtained by a survey of all farms in the area.

Agricultural Damages, Reach 8, Merrimack River, 1936 Flood

Type and Duration	Damages (dollars)	Damages (percent)
Buildings	$ 3,000.	2.7
Livestock	0	
Land and Crops		
Immediate	1,100.	1.0
Short-run	42,104.	38.0
Long-run	63,158.	57.0
Miscellaneous[1]	1,515.	1.3
Total	$110,877.	100.0

[1] Fences, irrigation, drainage, small structures.

Others floods have caused damage, but to a much lesser extent than the 1936 flood. The extent of these losses will be determined for the whole river valley.

The farmers were asked specifically if the general flood danger from the river had affected their land use and whether the reduction in flood danger after the construction of the reservoirs affected their land use. Most of the farmers stated that the reservoir operation had been beneficial, but that flood danger before or after construction did not affect their land use. They would not change their particular use of land if the river were fully controlled.

The same answer was made to the question regarding any enhancement in the use value of the land. Most farmers felt that the construction of the dams did not make certain lands usable for intensive cropping which were not usable before.

This means that to a considerable extent the farming decisions made in the river valley are not based at all on danger of floods. Some minor adjustments are made in vegetable farming because of the danger of water covering certain acreages in the spring, but farmers maintained that these adjustments were of small consequence to their operations.

W. F. Henry

OTHER ACTIVE PROJECTS

Factors Influencing Sales of New Hampshire Melons

L. A. Dougherty

Agronomy

"Merrimac", a New Potato Variety

For several years the Department of Agronomy has tested in New Hampshire potato seedling progenies developed by the United States Department of Agriculture, at Beltsville, Maryland, and Presque Isle, Maine. One of the varieties thus far developed has proved to be of commercial value and has been named Merrimac.

Merrimac is a high yielding variety of excellent quality which is very well adapted to this state. It is excellent for the manufacture of potato chips, has good keeping quality, and is resistant to late blight and ring rot.

More potato varieties are being tested and propagated, several show promise, and may eventually replace some of the varieties now grown in the state.

P. T. Blood

Search Continued for a Perennial Red Clover

New Hampshire perennial red clover was hand planted for comparison with Dollard, Kenland, New Brunswick, and Pennscott red clovers in July, 1953. Each strain was replicated four times. Yield harvests were made in mid-June and early August with considerable variation in yields due to the slope of the land and position of the individual plots.

In July, 1954, the above tests were duplicated on more level land and more uniform soil conditions. For comparison, three replications of each strain were seeded with the new belt seeder and one replication was hand seeded.

Some of the New Hampshire perennial red clover plants in the greenhouse are now over three years old. These plants are the source of the new breeder's seed. In recent years, seed has been taken from plants in the field which had persisted for five years.

L. J. Higgins

Better Adapted and Higher Yielding Corn and Grain Varieties

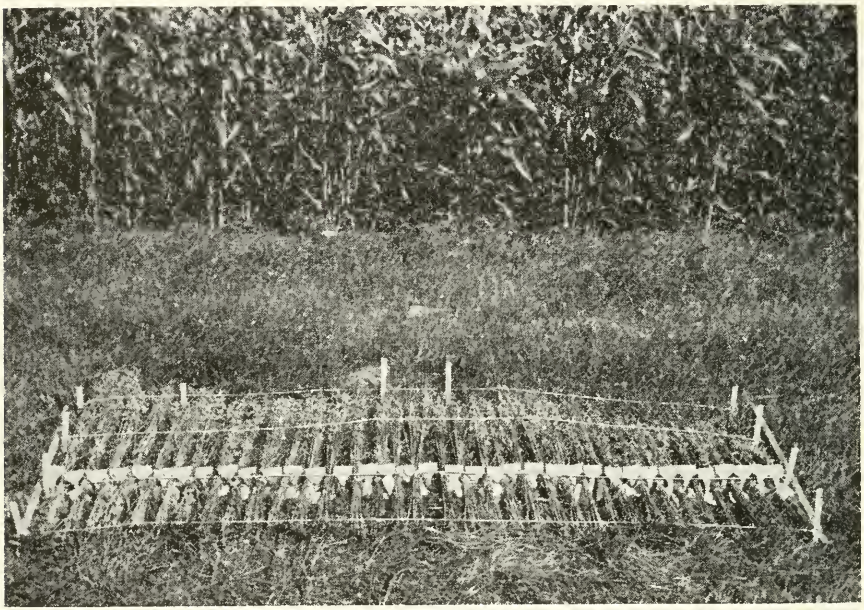
Cornell 29-3 has been an important corn hybrid for both silage and grain for several years. Unfortunately, it has suffered considerable stalk breakage and is not as uniform as some of the more recently developed hybrids.

In order to find which hybrids will best replace Cornell 29-3 and under what conditions these varieties will give the best silage returns, the usual corn variety trials were modified in 1953. Eight open pedigree hybrids in the same maturity range as Cornell 29-3 were chosen for the tests.

The nine hybrids were each replicated four times for each of four treatments. Two population levels of over 14,000 and over 19,000 plants per acre were established by proper thinning. Two fertilizer variations were set up by using 1-1-1 and 1-2-2 fertilizer ratios at planting and by varying the amount of nitrogen added as a side-dressing when the plants were knee-high.

The 1953 yields appeared to be somewhat masked by the extended

summer drought. There were no significant yield differences for either the population levels or the fertilizer variations. There were significant yield differences in the average yields of all treatments for the varieties. The earliest maturing variety returned better than 14 tons of silage per acre and the latest maturing variety produced 22 tons per acre. Four hybrids gave higher silage yields than Cornell 29-3. In this dry year all varieties matured except the latest hybrid.



A number of oat varieties were tested for forage as well as for grain yields.

In 1954 the same set-up with respect to treatments was used. Three earlier maturing hybrids were substituted for the three latest maturing varieties of 1953. To date, the rainfall has been ample and observed differences have been noted. The higher amount of nitrogen used as a side-dressing seemed to give the desired response.

New Hampshire farmers planted the new Clarion oat in place of Clinton for the first time in 1954. Results as regards yield and quality have favored the Clarion over the Clinton in the northeastern uniform nursery oat trials. The new improved Gerry and a New York selection appear to be well adapted and high yielding in the trials. If they prove their worth, the seed will be multiplied and available to oat growers. At this time, Clarion and Ajax are the recommended varieties to plant.

L. J. Higgins

Radioactive Phosphorus Absorption by Potato Leaves Shows that Phosphorus Fertilizer Can Be Applied as a Foliage Spray

Using phosphorus compounds tagged with radioactive phosphorus, it was found that up to 3.5 percent of the total phosphorus in the tubers at harvest time had been derived from the phosphorus sprayed on the potato

leaves. The seven sprays applied contained only a total phosphorus equivalent to an application of 5.9 pounds of P_2O_5 per acre; therefore, its efficiency of utilization was approximately 5.7 percent. On the other hand, where 200 pounds of P_2O_5 was applied to the soil as a fertilizer, its efficiency of utilization was considerably less than 5 percent. The total phosphorus needs of the crop are more adequately taken care of by the native soil- and fertilizer-phosphorus treatments since these two together accounted for more than 90 percent of the total phosphorus in the plant. It appears improbable that foliar feeding of the potato crop without root feeding can adequately take care of the plant's requirements for phosphorus.

L. T. Kardos

Potato Scab Easier to Prevent Than to Cure

Five hundred pounds of lime per acre per year were applied on scab-free potato soils with a pH of 5.09. Potato scab gradually built up as the pH was raised by the use of the lime to 5.28, to the point where the potatoes were not marketable. The lime was then omitted until the pH dropped to its original 5.09, and even at this pH, scab incidence was 63 percent. By contrast, nearby plots at the same pH which received no lime continued to be free of scab. This indicates that once the scab organism population builds up it is a very slow process to get rid of scab.

Adjacent plots in rotation which had received the same amount of lime were scab-free. This means that it is important for a potato grower to use soil-building crops in rotation in order to maintain a satisfactory level of organic matter.

P. T. Blood

Legume-Grass Yields Highest without Nitrogen Fertilizer

During the second year of harvest, the highest yields of a ladino clover-bromegrass mixture were made with no nitrogen fertilizer. The best yield was slightly in excess of three tons of dry matter per acre, and the fertilizer treatment consisted of 120 pounds of P_2O_5, 240 pounds of K_2O, 10 pounds of borax per acre, and no nitrogen fertilizer. The lowest yielding plot received only 60 pounds of P_2O_5 per acre.

Yields were in direct proportion to the amount of potash applied. The percentage of ladino clover was decreased by the application of nitrogen fertilizer, but increased by potash fertilization.

R. L. Donahue, P. T. Blood

Narragansett Alfalfa Proves Superior

Narragansett alfalfa maintained its superiority in yield over five other varieties for the third consecutive year. This variety of alfalfa has also been outstanding in other northeastern states.

Yield tests were conducted in 1953 on alfalfa at Greenland, ladino clover at Durham, and on smooth bromegrass at Dover and Colebrook. Yield tests were established in 1953 for nine strains of ladino clover at Dover and Colebrook.

Certified Oregon Ladino produced somewhat higher yields than the ther strains in this test during 1953.

The southern type bromegrass varieties such as Fischer and Achenbach were superior to northern type varieties at both locations.

G. M. Dunn, L. J. Higgins, P. T. Blood

Breeding of Grasses and Legumes in the Search for Superior Plants

Breeding activities with bromegrass included: (a) The establishment of a polycross nursery for progeny testing of selected plants; (b) The artificial inoculation and selection for resistance to brown leaf spot; (c) A correlation study on leafiness in bromegrass; (d) Crossing of selected bromegrass plants in the greenhouse.

It was found that seedling brome plants are very susceptible when artificially inoculated by the brown leaf spot organism, although some plants produce more resistant progeny than others. Of about 1500 plants which were inoculated, approximately 25 plants seemed to have some resistance to this disease.

The correlation study on leafiness with approximately 200 selected plants involved the following characteristics: (a) Leafiness as determined by a visual rating; (b) Leafiness as determined by dried weight of the separated leaves and stems; (c) Leaf length; (d) Leaf width; (e) Height of plant.

The plants differed greatly in leafiness as determined by weight of the dried leaves and stems. A significant positive correlation existed between (a) and (b) and between (b) and (e). A highly significant negative correlation was found between (b) and (c). The objective here is to select for and against leafiness, and to find associated characters which may aid in selection for leafy plants.

Breeding activities with ladino included:

(a) The establishment of a breeding source nursery, involving approximately 2400 plants of 70 to 80 strains of ladino. Observations taken on these plants include winter hardiness, maturity,

Ladino clover in its second year of growth in the breeding nursery.

density, recovery from diseases, plant type, and the amount of flowering.

(b) A greenhouse and field study of morphological characters associated with persistence. The characters studied in six widely different strains were: seedling root systems, date of initiation of stolons, stolon number, stolon diameter, and petiole length. These plants were transplanted to the field in an attempt to correlate these characters with persistence.

It is expected that progeny testing of selected plants in ladino clover and bromegrass will be begun next year to determine their suitability as parents for new varieties. Selection will be continued for brown leaf spot resistance in bromegrass, and it is planned to begin artificial cold-temperature studies with ladino clover as an aid in selection for persistence and winter hardiness.

G. M. Dunn

Irrigation Water and Nitrogen Fertilizer Can Be Wasted

Highest yields of a soybean-Hungarian millet mixture were obtained with one inch of water a week plus a top-dressing of 50 pounds of nitrogen fertilizer. An additional inch of water and 50 pounds more of nitrogen did not further increase yields.

The experiment was carried out on a deep sandy soil adjacent to the Merrimac River. Fertilization at time of seeding consisted of an application of 740 pounds per acre of a 5-10-10 fertilizer.

R. L. Donahue, P. T. Blood, S. A. Miller

Lime Makes Potash More Efficient

In northern New Hampshire, a ladino clover-bromegrass mixture produced the most forage when the soil was treated with 2 tons of lime and 100 pounds of K_2O applied in split applications. Responses in the southern part of the state were similar. It is especially significant to note from this experiment that at the higher levels of lime, it is not so important to apply potash in split applications. It appears that lime makes potash available to plants over a longer period of time.

L. T. Kardos

Birdsfoot Trefoil a Superior Legume on Soils of Low Fertility

Birdsfoot trefoil on soils of low fertility persisted longer than did alfalfa, ladino clover, or red clover. This was true both in southern and northen New Hampshire. Three years after seeding in the northern part of the state, both alfalfa and ladino clover comprised less than 5 percent of the stand. By contrast, birdsfoot trefoil comprised 17 percent.

On a droughty soil in southern New Hampshire, alfalfa averaged 2690 pounds of dry matter, birdsfoot trefoil 1930 pounds, and ladino clover 480 pounds per acre per year.

L. T. Kardos

Root Habits Can Be Changed

Experiments indicate that ladino clover and alfalfa roots can be made to use the deeper layers of the soil more fully. For example, by fertilizing

and liming the deeper layers and at the same time increasing the air capacity or "breathing capacity" of these layers, not only was a larger quantity of ladino clover roots developed, but also there were four to five times as many roots in the 12-18" layer as there were in the normal soil at this depth.

In the case of alfalfa, the tap root penetrated to a greater depth and the quantity of fibrous roots in the 12-18" layer almost tripled.

In field plots where a chisel tool was used to loosen compact sub-soil layers, the improvement in soil structure was found to persist into the second year.

L. T. Kardos

OTHER ACTIVE PROJECTS

Soil Survey of Rockingham County

W. H. Lyford

Bacteriology

Diagnosis and Control of Vibriosis in New Hampshire Dairy Herds

Attempts were made to isolate strains of *Vibrio fetus* from cows in New Hampshire dairy herds and to use these as antigens for studying the prevalence of vibriosis in the state. No pure cultures of this organism could be obtained from 6 fetuses submitted for culture. Apparently there is little vibriosis infection at the present time in the dairy herds in this state and it is difficult to obtain sufficient culture material for extensive studies. The project will be terminated because of lack of culture material and *Vibrio fetus* infected herds.

L. W. Slanetz

Studies on Bovine Mastitis

Particular attention was given to the use of staphylococcal toxoid for the prevention or control of staphylococcal mastitis in dairy cattle. Two experimental cows developed definite increases in antitoxin titers following the administration of the toxoid. These cows did not develop acute mastitis when injected via the teat canal with virulent strains of mastitis staphylococci. These organisms did produce acute mastitis when injected into these cows before the toxoid was administered. Forty milking cows have been given 2 or 3 injections of this toxoid and studies are in progress to determine the value of this immunization for preventing the development of acute cases of staphylococcal mastitis or new infections in these cows. Similar studies are being conducted on a group of 20 pregnant heifers injected several weeks before calving. Antitoxins titers are being followed in these cows. Achromycin and a combination of aureomycin, neomycin, streptomycin and penicillin ointment are being tested for the treatment of staphylococcal and streptococcal mastitis.

L. W. Slanetz, F. E. Allen, G. V. Keefer

Botany

New Blight-Resistant Tomatoes Show Promise

About a dozen lines of tomatoes have been selected which are highly resistant to *Phytophthora infestans,* the organism which causes late blight of

potatoes and tomatoes. Most of these lines have good fruit size and shape. The more resistant lines which have the most desirable horticultural characters will be selected for further trial and increase.

A. E. Rich

Propagation of Woody Plants

Two types of propagation beds have been tried, one under shade in a greenhouse and the other an outdoor bed shaded with burlap. The latter was tried as an inexpensive propagation method. Both beds were supplied with constant mist by spray nozzles. The indoor bed gave a higher percentage of rooting, but the outdoor one gave indication of being useful, especially with a new type oil burner nozzle tested late in the season.

Limited tests with cuttings of other kinds, such as new *Rubus* crosses and those of hazel-filbert, gave indication that constant mist is a good method for rooting these plants.

With sugar maple cuttings, a total of 190 rooted out of 1152 planted. The rooted cuttings were potted in soil and stored in an outdoor bed covered with sawdust. Considerable winter-killing was noted the following spring (1954). All but a few failed to survive.

S. Dunn

New Organic Fungicides Show Promise for Disease Control under New Hampshire Conditions

Sulfur is being replaced by new organic fungicides for control of apple scab because they give more effective control and better fruit finish. Phygon has given excellent scab control, but sometimes causes injury to both foliage and fruit. Captan and glyodin have given good scab control and excellent fruit finish. Several phenyl mercury formulations have proved effective in precover sprays as "eradicants", but they tend to delay ripening.

Maneb gave the best control of potato late blight in 1953, followed by nabam plus zinc sulfate, dichlone, and captan.

Neither captan nor ferbam increased the yields of low-bush blueberries in 1953. However, the dusted foliage appeared healthier than the untreated plants.

A. E. Rich

Virus Diseases of Strawberries in New Hampshire

Preliminary studies suggest that cultivated strawberries and wild strawberries growing near them are rather generally virus-infested, even though no marked foliage symptoms are evident. It is probable that the viruses reduce both runner formation and yield.

A. E. Rich

Effective Materials and Methods for Composting Sawdust and Other Wood Wastes

Experiments on composts of sawdust and shavings were continued. Results on yields of various crops grown in mixtures of these composts with soil, as compared to those grown in soil only, showed again that hen manure or green vegetation, or both, were good composting aids for wood wastes. Sewage sludge was of doubtful value in this respect. Krilium as a soil con-

ditioner did not compare favorably with the best of these compost mixtures in aiding crop growth. Commercial fertilizer, with and without lime, did not produce good composts.

Outdoor wooden bins as containers for composts proved to be superior to pits dug in the soil. Ease of handling and good drainage were important factors here.

S. Dunn

The Flora of New Hampshire

The most important Herbaria have been canvassed for specimens of woody plants. Plants have also been collected from all parts of New Hampshire. Data has been taken with the aim of publishing a much needed review on the flora of the woody plants of the state in the near future. Considerable field work has also been carried on to increase our knowledge of the wild plants in certain parts of New Hampshire. In particular, a fairly successful attempt has been made to locate all of the wild Rhododendron colonies in this area. One woody species, the Inkberry, was found for the first time in New Hampshire last year. It has also been possible to cooperate in our flora investigations with our plant pathologist in some of his studies involving virus in strawberries as well as Ash rust.

A. R. Hodgdon

New or Unusual Diseases in New Hampshire

Dutch Elm Disease continued to increase in distribution and severity in 1953.

Ash leaf rust was very serious in southern New Hampshire in 1953 and 1954.

Needle browning of white pines is prevalent in the young needles this season (1954), apparently due to climatic conditions. No parasitic organism appears to be involved.

Needle blight of red pines was again serious in 1953. Studies have shown that it is associated with injury by a gall midge.

Pea root rot was a problem in 1953 and 1954. Preliminary studies indicate that a Fusarium is involved.

A. E. Rich

OTHER ACTIVE PROJECTS

Control of New Hampshire Weeds Using Herbicidal Methods

A. R. Hodgdon

Dairy Husbandry

New Method of Determining Gross Energy and Protein in Plant Materials Shows That Silage Excells Comparable Hay in Nutritive Value

A new method for determining the protein and the gross energy of silages and other high-moisture containing substances without drying the samples by means of an adiabatic bomb calorimeter has been perfected at the Agricultural Experiment Station.

The fresh sample is finely pulverized by means of a meat grinder and 95 percent ethyl alcohol is used as a primer in burning a weighed amount of the fresh material in the bomb calorimeter to determine the gross energy.

The protein also is determined on a representative sample of the fresh material. Comparison of the results of this method with those using conventional drying show that there are losses of gross energy and protein as high as 10 percent due to drying.

When these corrections are applied to the values for silages reported in New Hampshire Agricultural Experiment Station Bulletin 409, p. 17, 1954, they show that the silage excells both the mow-cured hay and the field-cured hay in gross energy and digestible protein.

N. F. Colovos, H. A. Keener,
A. E. Teeri, H. A. Davis

Methane Production Uniform in Ruminants Fed Roughages

In approximately 400 nutrition balance experiments with dairy cattle at the Metabolism Laboratory of the New Hampshire Agricultural Experiment Station, the methane production was measured directly with a Carpenter methane gas analysis apparatus. In about 130 of these experiments, dairy cows received a ration consisting solely of roughage. The production of methane in all these roughage evaluations was remarkably uniform within plant species when they were fed as a maintenance ration or slightly above.

From this, it is concluded that a prediction formula for methane may be worked out using the digestible energy content of the ration. Such a value, along with the factor for estimating the energy loss in the urine, can then be used to estimate fairly well the metabolizable energy of the ration. If a similar prediction formula for heat increment of the ration can be worked out, it will be possible to make an estimate of the net energy.

Efforts are being made in the laboratory to determine such factors for estimating heat increment.

N. F. Colovos, H. A. Keener,
A. E. Teeri, H. A. Davis

The Excretion of Vitamin B_{12} by Cows

The amount of vitamin B_{12} synthesized in the gastrointestinal tract of cows is relatively very great as indicated by the fact that excretion of this substance exceeds intake by many times. The fact that approximately 99 percent of the excreted vitamin B_{12} is in the feces suggests that this vitamin is either poorly absorbed or that it is metabolized to some other compounds. Preliminary results with rations consisting of hay, hay with oats, and hay with corn indicate that the extent of synthesis of this vitamin in the intestinal tract of cows may be affected by alterations in the ration.

A. E. Teeri, D. Josselyn,
N. F. Colovos, H. A. Keener

Vending Machines Increase Use of Fluid Milk

Vending milk in coin-operated package machines was started in the University dormitories on the campus in the fall of 1951. During the University year 1951-52 there were only 6 machines in operation, but in the fall of 1952, 7 more machines were placed in operation. For the last 2 years there has been a machine in all of the dormitories on the campus.

In the first year of operation 61,376 half pints were sold in 6 machines; last year, 133,916 half pints, and this past year, 134,848 half pints were sold in the 13 machines. The machines also are used for Summer School and conferences, and the total sales to date has been 344,952 half pints of homogenized milk, chocolate milk, and coffee milk. The containers with coffee milk were added to the list in November, 1953. Over 86,000 quarts of milk were sold; nearly all of this can be considered as additional usage.

This year with three types of milk in the machines, the girls used 43.1 percent plain, 35.1 percent chocolate, and 21.8 percent coffee; the boys used 30.4 percent plain, 43.8 percent chocolate, and 25.8 percent coffee. Last year the girls used 51.9 percent plain and 48.1 percent chocolate, while the boys used 32.8 percent plain and 67.2 percent chocolate.

The consumption per student per day last year was 0.27 of a bottle and this year it was 0.29 of a bottle. The consumption in the girls' dormitories was 0.41 of a bottle last year and 0.46 of a bottle this year. In the boys' dormitories the consumption was 0.22 of a bottle for both years. The greater consumption on the part of the girls can be explained largely by the fact that in two dormitories the girls do some cooking, and the consumption per girl in these dormitories was 0.80 and 0.61 of a bottle per day. In a dormitory where all the girls are freshmen and are required to eat in the University Dining Hall, the consumption was 0.26 of a bottle per day.

A cone paper bottle with a cover cap is used at a cost of about 2.15 cents per unit. Depreciation and repairs to date has been about 0.5 cents per unit, leaving 7.35 cents per bottle to cover cost of servicing the machines and for the milk. Most of this time the price of a half pint of milk delivered has been 6.5 cents, and if we assume we can process and deliver a unit to to these machines for 6.5 cents, it leaves a profit of 0.85 cents per unit sold in the machines.

Sales of soft drinks for the college year 1952-53 in the dormitories dropped 33.9 percent compared with the previous year when 6 milk machines were in operation. When compared with the sales of soft drinks in 1950-51, when no milk vending machines were in operation, the drop in sales of soft drinks last year was 59.1 percent.

H. C. Moore

More Extensive Use of Grass Silage for Dairy Calves and Heifers

The possibility of using grass silage more extensively in feeding dairy cattle is being studied. Twelve Holstein and 12 Guernsey heifers are being fed from a few days of age to calving on milk replacement, a limited amount of concentrate mixture, and one of the following roughage combinations: grass silage alone, grass silage plus limited hay, grass silage plus corn silage, grass silage plus corn silage plus limited hay. The concentrate part of the ration of each animal consists of 200 pounds dry calf starter and 300 pounds 16 percent dairy grain mixture. The maximum amount fed per day is 2.5 pounds and no grain at all is fed after the animals are 9-10 months of age. This type of feeding program was planned in order to bring out maximum differences between roughage combinations and also to determine what gains can be obtained when limited amounts of grain are fed.

Results to date indicate that good quality grass silage can be fed successfully to young dairy calves. No benefit has been observed from feeding hay and grass silage to the Guernseys, but the Holsteins receiving limited

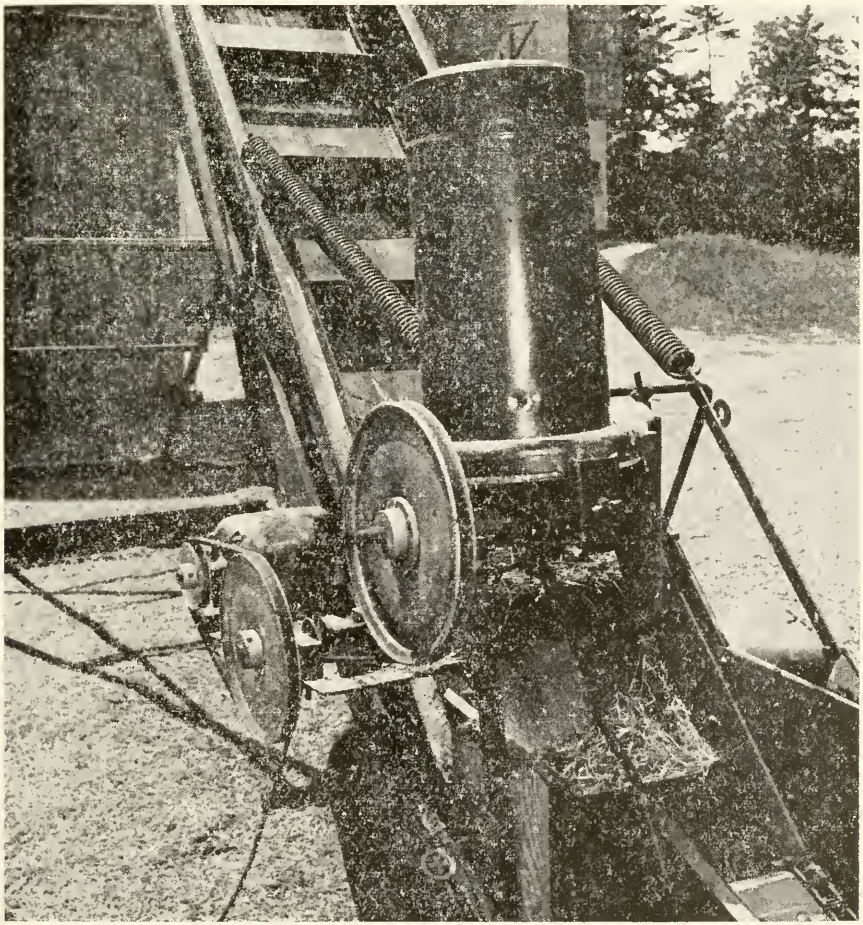
hay are considerably larger than those receiving grass silage as the sole roughage. The animals receiving corn silage with grass silage have grown the poorest in both breeds, but the addition of hay to this combination has improved growth to some extent. The animals of this experiment appear to be in good condition generally and would be accepted as normal in most dairy herds.

H. A. Keener, N. F. Colovos

Bisulfate Applicator Can Be Made from Corn Planter

Gravity type applicators used for applying sodium metabisulfite to forage at time of ensiling have not worked satisfactorily. The bisulfite bridged over and constant attention was required to keep the material flowing. Types tested included one built to be mounted on the field chopper and another mounted above the feed table of the forage blower.

A revolving pan type fertilizer attachment from a corn planter or side dressing cultivator was converted into a very satisfactory applicator. Power



A bisulfite applicator made from the fertilizer attachment of a corn planter.

was supplied by a ¼ H.P. electric motor, but it could be supplied by some moving part of a blower or conveyor. A wide range of delivery could be obtained by means of a thumb screw under the revolving pan. It appears that a positive type of applicator is the most satisfactory.

P. A. Gilman

The Value of Balsam Fir as Food For Deer

The nutritive value of balsam fir, *Abeis balsamea,* an evergreen abundant in New Hampshire woods, was determined in feeding tests with young deer. Cooperative experiments were conducted by the Agricultural Experiment Station and the Fish and Game Commission of the State of New Hampshire to determine the nutritive value of the forages available in the woods to deer during the winter.

Using yearling male deer, specially constructed metabolism stalls, the indirect calorimeter, and the other facilities of the Metabolism Laboratory of the Dairy Husbandry Department, a series of complete nutritive balances were made on this forage with the deer receiving it as the sole ration.

The results of the experiment show that even though the deer ate at an average rate of about 5 pounds of the balsam fir per 100 pounds of body weight, the ration was considerably under maintenance level both in energy and protein. The digestibilities of the energy and protein were quite low, 47 and 27 percent, respectively. The utilization of the ration was very low also, with high minus balances in both energy and protein indicating that the animal was drawing on its own body for maintenance. Loss in body weight substantiated this.

It is concluded that this forage is of low nutritive value and at best can serve deer only as a sub-maintenance diet which, if prolonged, would result in the animal dying from starvation.

N. F. Colovos, H. A. Keener,
A. E. Teeri, H. A. Davis

Vitamin Synthesis in the Rumen of Deer

There is a considerable amount of synthesis of certain vitamins in the rumen of deer, as indicated by the urinary and fecal excretions of these vitamins when deer were fed a ration consisting of balsam fir. While the synthesis of nicotinic acid and riboflavin was slight, that of thiamine, and particularly of vitamin B_{12}, was much more extensive.

Vitamin synthesis by rumen microorganisms is an activity common to all ruminants, but it appears to be especially high in the case of deer. This fact is of particular importance to those animals which often may be subjected to a rather limited type of diet.

A. E. Teeri, N. F. Colovos, H. A. Keener

The Relation of Seminal Fluid Fructose Levels to Factors Affecting Breeding Efficiency

Semen fructose analyses have been made on 408 ejaculates representing 34 bulls of the following breeds: Guernsey, Hereford, Holstein, and Jersey. These ejaculates represent 306 first ejaculates, 86 second ejaculates, and 16 third ejaculates.

ejaculates for the first, second, and third days after shipment.

Fructose analyses were made on the initial level and one, two, and three hours after incubation. Breeding efficiencies were calculated on all

Although the data has not been treated statistically, there is evidence that:

1. There is no relationship between the initial fructose level and breeding efficiency.
2. There is a relationship between sexual libido and initial fructose level.
3. There is a relationship between initial fructose level and first and second ejaculates.
4. There is a relationship between the rate of fructose utilization and breeding efficiency.
5. There are differences between the breeding efficiencies of first and second ejaculates from the same bulls.

C. H. Boynton

Low Trace Mineral Content of Feed Does Not Appear to Adversely Affect Reproduction in Dairy Cows

Timothy and ladino-clover-bromegrass hays grown under conditions of heavy fertilization of the soil are low in cobalt, iron, and copper. The content of certain other mineral elements appear also to be decreased somewhat.

When the low-mineral hays were fed to dairy calves and heifers along with a low-mineral-grain mixture and a cobalt supplement, symptoms observed in the animals were slow growth, anemia, ataxia of rear quarters, and pulling of head upwards and backwards. In older cattle symptoms observed were anemia, low milk production, very rapid loss of body weight following parturition, and the giving birth to calves with goiter.

The feeding of the low-mineral timothy hay does not appear to have had any adverse effect upon reproduction. During the first two years that animals on the experiment were being bred, the ladino-brome fed animals required over twice as many services per conception as the timothy fed animals. The past year the ladino-brome fed animals conceived as well as the timothy fed animals, but the percentage of ladino clover in the mixture was low, due to adverse weather conditions. While these results suggest that some factor which interferes with conception may be present in ladino clover, conclusive proof of this must await further studies.

H. A. Keener, F. E. Allen, C. H. Boynton,
H. A. Davis, K. S. Morrow, G. P. Percival

OTHER ACTIVE PROJECTS

The Influence of Herd Management Practices on Milk Production, Efficiency of Reproduction, and Herd Replacement Maintenance

K. S. Morrow

Entomology

Testing New Organic Insecticides under New Hampshire Conditions

In comparative tests against mites on apple foliage, Malathion (25 percent w. p.) at 2 pounds per 100 gallons was superior to Parathion (25 per-

cent w. p.) ; both materials gave satisfactory control for a period of one month following a single application. Malathion has a distinct advantage over Parathion for the average grower, inasmuch as it is much safer to handle and will give very good results in controlling other important apple insects, as well as mites.

An attempt was made to control horse flies and horn flies on dairy cattle. Two materials were used for this purpose: Sulfoxide-Pyrexcel wettable powder and Sulfoxide-Pyrexcel emulsion. Under field conditions it was found that both materials protected the animals from horse flies for three days. The species of horse flies involved were *Tebanus typhus* and *Tebanus lasiopthalmus*. Both of the insecticides used gave protection to cows from horn flies for nine days during the period when untreated animals were more or less continuously heavily infested.

Control of horse flies in the University Livestock Barn was attempted by the use of Malathion sugar baits. It was found that the sugar bait method was effective in reducing fly populations satisfactorily, providing the baits were replenished every three days during the season when flies were particularly troublesome.

Fly breeding in manure was controlled effectively by the application of Malathion sprays at intervals of four days.

J. G. Conklin, R. L. Blickle, W. J. Morse

Factors Affecting the Action of Acaricides

An attempt was made to determine whether the two-spotted mite, reared under different humidity conditions, would exhibit any difference in susceptibility to acaricides. Acaricide tests were run on six different mite populations which had been reared under constant humidity conditions of 10 percent, 28 percent, 44 percent, 60 percent, 75 percent, and 80 percent, respectively, and under temperature conditions ranging between 75° F. and 80° F. It was observed that mites reared at humidities between 10 percent and 50 percent developed faster and in greater numbers than did those at the higher humidities of 75 percent and 80 percent. In these tests there were no significant differences in susceptibility to the acaricides under the 6 different humidities.

R. L. Blickle, W. J. Morse

Forestry

Soil-Yield Relationships of White Pine in Southern New Hampshire

Since 1952 data has been taken on 37 white pine sample plots. The mensurational characteristics of the forest and the properties of the soil have been recorded for each plot.

A preliminary set of site-index-curves for white pine has been prepared. Various regressions with their correlation coefficients have been calculated and it was found that a strong correlation exists between certain soil properties and site-index. As more plots are established in the coming year, it is believed that stronger correlations will be found.

B. Husch, W. Lyford

Marketing Forest Products Is an Important Phase of the Agricultural Economy of New Hampshire

Woodland owners throughout the State were interviewed in order to secure from them information about practices, facilities, and the prices they receive from the sale of their wood products.

The information has been analyzed, and when a summary is completed, it should reveal the present status of marketing from the woodlot owner's point of view.

To present a balanced study, it is also desirable to secure information from the buyer or the first handler of these products. This information is now being gathered through interviews with owners of sawmills, pulp mills, excelsior plants, wood dealers, and others. About 45 such contacts have been made.

As soon as the sampling process is completed, all of the information will be integrated and the results published.

L. C. Swain

The Utilization of Products from Chemically Treated Trees

Chemically killing instead of cutting unwanted trees to improve composition and quality of the forest is a new and economical approach to an important practice.

When trees are killed and remain standing, changes take place in the bark and wood which may affect the utilization value of these trees. If they are suitable for fenceposts, it is important to know their drying rate.

To secure information on white pine trees normally removed in thinning, 70 pole size trees were selected and numbered in November, 1953. The odd numbered poles were treated with sodium arsenite tabs. The even numbered trees were untreated and used as controls.

At two-week intervals one treated and one untreated tree was cut. seven-foot poles were sawed from both trees. At the end of the first 7-foot cutting, wood samples were taken for moisture determination. Internodal sections were also taken for the same purpose near the tops of the trees.

From 17 pairs of trees so far examined, it was found that a fairly gradual moisture loss occurred during the first 26 weeks. After that, the rate of loss was much greater.

A second plot of 100 trees received similar treatment in May, 1954. Not enough observations have been secured so far to show definite trends.

L. C. Swain

Results of an Investigation of the Variable Plot Method of Cruising Timber

A major activity in forestry is the determination of standing timber volumes. Within recent years a new approach has been developed which promises to speed up timber volume estimation. Briefly, this new variable plot method consists of establishing a number of sampling points in the timber stand to be inventoried. The estimator then occupies each sampling point successively. He views the diameter of every tree visible from each point, counting the trees whose diameter appears larger than a hand held angle gauge. The total count of all trees, divided by the number of sampling points, multiplied by a constant, will give an estimate of average basal area

per acre. Other timber survey statistics can be developed by varying the procedure.

In this study, four contiguous ten-acre tracts were cruised by the variable plot method using the three critical angles: 52.09′, 104.18′, and 208.38′. A complete tally of all trees was then made of the same area for comparison.

From the standpoint of efficiency based on both accuracy and required time, the 208.38′ critical angle proved best. The basal area determination for the 40 acres was only 4.6 percent low and the boardfoot volume estimate was 7.6 percent low. There were slightly greater deviations for the individual 10-acre tracts. The results of the estimates with the 52.09′ critical angle were much more inaccurate. For the 40 acres the basal area determination was 47.8 percent low and the volume estimate was 47.5 percent low. Again, somewhat greater deviations were found for the individual 10-acre tracts. Using this angle, the number of estimating points that can be used on an area are limited and many trees which should be counted are missed because of adverse sighting conditions. The estimates with the 104.18′ critical angle gave basal area and volume figures intermediate between those found for the other two angles. In addition, it required the greatest length of time.

It would appear that the method of variable plot cruising works best with a wide critical angle used at the maximum number of estimating points.

B. Husch

OTHER ACTIVE PROJECTS

Reproduction Studies in White Pine

C. L. Stevens

Home Economics

Human Nutrition Research

This past year, twelve male students from the University voluntarily participated in a nutritional research project to investigate the rate of phosphorus supplement as it might effect the utilization of thiamine, one of the B complex vitamins, and carbohydrate.

The young men, ranging in age from 18 to 24 years, were fed a constant basal diet for a period of 10 weeks. All food for this experiment was weighed, prepared, and served in the Food and Nutrition Laboratory in the Department of Home Economics. The subjects were required to eat all the food served to them and no additional foods were permitted. They lived together as a unit at one of the men's dormitories.

The basal diet contained 2500 calories, 0.8 grams of phosphorus, and was adequate in all other nutrients for the age group, according to the Recommended Allowances of the Food and Nutrition Committee of the National Research Council. Since the men differed in age, height, weight, and activity, each individual's energy needs above the basal diet were provided for by the addition of purified carbohydrate and fat. All subjects remained on this regime for 5 weeks, after which time half of the students were given additional phosphorus. None of the men knew who was receiving the additional phosphorus as it was incorporated in the diet. The quantity of phosphorus was increased at ten day intervals until they were eating four times the quantity in the basal diet. Six of them remained on the basal diet

for the entire 10 day intervals until they were eating four times the quantity contained in the basal diet. Six of them remained on the basal diet for the entire 10 weeks to serve as controls.

Blood and urine samples were taken 24 hours after phosphorus intake and analyzed at regular intervals throughout the experiment for a total of 6 collections. All subjects were periodically examined by the University physician. The men remained in good health throughout the experiment.

On the basis of the blood and urine analyses performed, it does not appear that the varying levels of phosphorus had much, if any, significant effect on the sugar or thiamine levels of the blood. This project is to be published in detail as a Station Bulletin.

A. M. Light, S. R. Shimer

Horticulture

Effect of Hay Mulch and Minerals on Yield of Northern Spy Apples

Northern Spy apple yields from 1948-1953 were greatest on plots which have received hay mulch since 1942-1945. Trees in mulched plots which received nitrogen plus phosphorus and potassium, or phosphorus plus potassium without nitrogen, gave no significant difference in yield from those grown under mulch without added minerals. Although just short of a 5 percent level of significance, there was an indication that yield was slightly depressed in mulched plots that received phosphorus and potassium without nitrogen. Trees in all hay mulched plots gave better yield than those grown without mulch, although the latter received nitrogen applications. It thus seems apparent that the main effect was an increased yield which resulted from hay mulch, and that added minerals produced no additional effect.

L. P. Latimer, R. Eggert

Sources of Magnesium for Apple Trees

An experiment was set up in 1951 to compare magnesium sulphate, dolomitic limestone, and sulpomag as sources of magnesium for root absorption by young McIntosh apple trees which were showing symptoms of magnesium deficiency. No differential effect due to treatments has yet been indicated by visual examination.

L. P. Latimer, R. Eggert, G. P. Percival

Annual Cropping Northern Spy Apple Trees Are High Yielders

Over the period 1946-1953 inclusive, regular annual-bearing northern Spy apple trees produced 50 percent more fruit than biennial-bearing trees. Other trees, intermediate in bearing habit between annual and biennial bearers, produced little more fruit than did strictly biennial bearers.

L. P. Latimer

Fruit Trees for Northern New Hampshire

Plums—Among the tree type plums, Red Coat has been outstanding for vigor, hardiness, and production of large, attractive, red fruits of good quality. Other promising varieties are: Tecumseh, Pembina, and Minnesota No. 101.

Trees of Underwood are growing vigorously, but have been susceptible to moderate to severe bark splitting in winter. Dietz, a European type, has shown good vigor but as yet has not produced any fruit.

Dura and Opata are outstanding among the bush plums growing at West Stewartstown. These are low growing and have produced the most fruit of any of the bush plums on trial.

Apples—Whitney has been outstanding among the apple varieties, being exceptionally vigorous and healthy and producing good fruit. Redwell shows considerable promise because of its vigor, freedom from winter injury, and production of some fruit this year. Red Duchess is very vigorous. The trees are of good form and have produced some fruit.

Cortland still seems very promising when scab infection is kept under control. Prairie Spy is healthy with some fruit, but may be too late to mature properly. Fireside showed wood injury in winters 1948 to 1950. Trees, however, are now vigorous and show a good set of fruit. Minjon is growing well but needs further testing.

Among the small fruited crab apples, Red River and Piotosh are exceptionally vigorous, followed by Dolgo.

Pears—None of the pears have produced fruit, although there has been some bloom. It is not known whether this is due to frost injury to blossoms or to lack of pollination. Patten is making excellent growth and is far ahead of Bantam or Pioneer in this respect; also, Patten has shown no evidence of winter injury in the wood as have Bantam and Pioneer.

L. P. Latimer, D. A. O'Brien, A. F. Yeager

New Red Horticultural Bean Variety Named Scarlet Beauty

Good bright red seed color and large seeds at the green shell stage of maturity are outstanding characteristics of the newly named Scarlet Beauty. The seeds shell easily from the pods. The shelled beans make an attractive market display because of the red seed color. Varieties of horticultural beans adapted to shelling by machine, such as a rotary-cylinder type of pea huller, are being developed.

E. M. Meader, A. F. Yeager

Korean Shrubs Are Ornamental and Attractive to Wildlife

Seedlings of *Sorbus alnifolia* from seeds collected in Korea in 1947 fruited at the Horticultural Farm for the first time in 1953. The 8-foot tree-like shrubs which are related botanically to both mountain ash and pear produced many clusters of small red fruits about ⅜ inch in diameter from the white flowers that resemble those of the pear. Both flowers and fruit are ornamental. The red fruits were particularly attractive to partridge or ruffed grouse.

Seedlings of *Elcagnus umbellata* from Korea have fruited for several years. The spreading 6-foot shrubs with leaves green above and silvery color on their underside will form a dense hedge. The rather inconspicuous small white flowers have a spicey fragrance. Small red fruits having a shape similar to and a single seed like an olive are attractive to fall migrating birds. The fruits made an acceptable jelly with a flaver and color similar to peach or plum jelly.

Seeds of both Korean shrubs have been distributed to interested persons and nurserymen.

E. M. Meader

Hybrid Chestnuts Resulting from Crossing Two Known Species

Untimely low temperatures (27° F. on September 23, 1953) froze immature chestnuts at the Horticultural Farm in Durham. Thus few nuts could be harvested from the Korean chestnut seedlings.

It was possible at another location to secure mature nuts from a hardy tree of *Castanea crenata* that had been pollinated with pollen from the American Chestnut, *C. dentata*. A few F_1-hybrid seedlings are being grown, also some seedlings that were backcrossed to *C. crenata*.

E. M. Meader

Superior Snap Bean Named Green Crop

Green Crop snap bean derived from crosses involving Bountiful, Australian, and Streamliner varieties has been tested under code number N. H. 23. The new variety, Green Crop, has long flat stringless green pods with white seeds and has proved valuable for processing. It is useful as a highly productive market variety. Pods mature uniformly and thus may be adapted to machine harvest.

Seed of Green Crop is being increased for distribution by the seed trade.

A. F. Yeager, E. M. Meader

New Hampshire Red Pickler Tomato

This new determinate pear variety of tomato is preferred to the indeterminate types that are used for pickles. Because of uniform setting of many green fruits at the same time, the crop of this determinate variety may be harvested readily by pulling up the plant and shaking it to remove the fruits. Over 1000 fruits have been harvested from a single plant.

A. F. Yeager

Chemical Weed Control Makes More Effective Fertilization in Low Bush Blueberry Fields

Fertilizing low bush blueberry fields not only stimulates low bush blueberries, but also the competing weed plants such as Sweet Fern, Hard Hack, Gray Birch, and others. In many cases the benefits of fertilizing the blueberry fields were neutralized because of the stimulated growth of the weeds which then dominated the fields. By proper use of the newly developed weed killing chemicals, it was possible to eliminate these weeds in the blueberry fields, thereby making the application of fertilizer practical.

W. W. Smith

Weed Killing Chemicals Are Essential in Reclaiming Blueberry Land

Blueberry fields have been abandoned because of the cost of controlling weeds, especially woody plants such as Maple, Gray Birch, Cherries, and

so forth. By stump and basal spraying of these woody weed plants, the reclaiming of abandoned blueberry land has become more profitable, and many growers are taking advantage of this new technique. Properly sprayed stumps do not resprout, while cutting without spraying is a continuous operation as the unsprayed stumps sprout annually.

W. W. Smith

New Raspberry Variety Named New Hampshire

Taylor Raspberries pollinated with pollen from *Rubus chamaemorus* more than 10 years ago were carried into the second generation and field tested under a wide variety of climatic conditions. A selection from this cross was distributed as New Hampshire raspberry No. 101. It is now given the name New Hampshire. It is a late bearing spring variety. Plants are medium in height, but strong and somewhat branched. The roots are unusually vigorous. It is a reasonably good plant maker. The fruits are conical in shape, very firm, good flavor, red in color with a very small cavity. Tests indicate that it has a high degree of winter hardiness. It has a long fruiting period carrying through much later than most standard varieties of red raspberry. It offers promise as a market variety for climatic conditions as found in New Hampshire.

A. F. Yeager, E. M. Meader

Do We Have a Virus in Our Apple Rootstocks?

The varieties McIntosh, Cortland, and Spy, top-worked onto body stocks of Virginia and Florence crab, came into production as quickly as trees budded directly onto domestic roots. The trees that body-stock rooted made excellent growth and production during the 12 year study. Trees of the same scion body-stock combination that did not root became dwarfed, developed "wood pitting" in the body stock, and broke down. Since the body stocks were on domestic roots, the difference in performance of the trees must be due to the variable domestic roots used for understocks. The inconsistent incompatabilities of Virginia crab with commercial apple varieties that have been reported in the literature may well be a result of the heterogeneous seedlings that were used for nurse roots, or of the nurse roots' response to a virus, and not an actual difference in the Virginia crab or in the varieties with which they were grafted.

The "wood pitting" and general appearance and behavior of the abnormal trees have a striking resemblance to the citrus trees infected with the virus disease "quick decline".

W. W. Smith

The Occurrence of Over-Coloring and Blotching in Apples on Double Worked Apple Trees

In 1950 in a hardy interstock planting it was noted that Cortland apples on two of the trees that had a Florence crab interstock had a blotchy overcolor, there being areas on the surface of the apples that were green. These areas were irregular in shape but had rather distinctive margins. In 1952 and 1953, more trees were discovered having apples of the same characteristics. In 1954 some sixteen trees in the orchard showed this over-color blotching. Fifteen of the trees were Cortland and one was McIntosh.

At the present time we have no explanation for this peculiar coloring. The apples are normal in every other way but are not very attractive. Scions of these trees bearing the abnormal colored apples have been budded into Malling 9 understocks to determine whether the characteristic blotchy color will be transmitted with the scion.

W. W. Smith

Malus Sikkimensis as an Understock for Semi-Dwarfed Apple Trees

Malus sikkimensis is apomitic (producing a uniform progeny) and thus has possibilities as a semi-dwarfed understock for our apple varieties. Some 40 grafted trees, including varieties such as McIntosh, Macoun, Northern Spy, Cortland, and Golden Delicious, are in their fifth season in the rootstock plots at Gilford. A few of the trees bore apples this year. At the present time, they appear to have a thicker trunk and wider spreading branches than the same varieties on seedling understocks. Since trees of Malus sikkimensis take 12 to 14 years to produce fruit, sikkimensis has been budded onto Malling 9 understocks in an attempt to obtain sikkimensis fruits, thereby obtaining sikkimensis seed for future studies of this promising understock.

W. W. Smith

A New Wick Watering Method for Potted Plants

A unique adaptation of the wick watering system of Post and Seeley was devised here as a means of supplying adequate water to pots of soil growing new hybrid callas.

In 8-inch pans callas use more water in a day than can be supplied by surface watering twice a day in sunny weather. Painted aluminum eaves troughs, plunged in sand to their rims lengthwise of the bench, form the reservoirs. A constant supply of water is maintained by a poultry float valve in each trough. Large pots rest directly on the trough rims and are watered by the capillary action of a glass fiber wick suspended in the water from the drainage hole in each pot. Small pots with similar wicks are supported on a ½-inch mesh wire screen laid over the whole bench of troughs. Callas in sand over troughs filled with 20-20-20 nutrient solution at a concentration of 1 teaspoon per gallon of water grew and flowered as well as those in soil over water alone. African violets and *Menzies Tolmeia* did well also.

Although this system of wick watering is not recommended for commercial production of greenhouse pot plants without modification, it is suggested for use by retail florists, and by housewives who do not find time to apply water correctly to mature, pot-bound flowering plants received from the florist.

E. B. Risley

Introducing Monarda "Granite Pink"

At the New Hampshire Agricultural Experiment Station a new perennial for northern flower gardens requiring only a minimum of maintenance and suited to most all types of gardens has been named "Granite Pink". Growing three feet tall and as wide across, this new member of the mint family is a seedling from a much taller variety, "Croftway Pink", which was introduced into the United States from Europe during World War II. Al-

though the Monarda (Bee Balm) is a North American wild flower, virtually all garden varieties have been developed in Europe from seed of our native species sent there as early as 1744. It is perhaps significant that we are at long last developing our own garden flowers from our own native species to fit the particular environment found here at home in Northern New England.

"Granite Pink" Bee Balm attracts both bees and humming birds in large numbers wherever it is grown. Its green-centered, bright pink flowers 2-½ inches in diameter literally cover the plants, not just over the top, but down the sides as well, forming a large mound of color in the garden starting about July 15th and not ending until September 1st. The plants are outstanding, not only for their unusually long period of bloom, but also for their ability to grow on wet or dry, heavy or light soils of moderate fertility. Bee Balms spread rapidly by stolons making large round clumps that may be divided to form new clumps frequently, if desired, or left to form one large, solid mass of pink flowers. This perennial is hardy without winter protection in most gardens as far north as Canada.

Increase of Monarda "Granite Pink" is under way and it is hoped that there will be plants available for everyone at local nurseries within three years' time.

E. B. Risley

Two Late Lilac Varieties Named

Two late blooming lilacs have been named during the past year. Both are seedlings of the variety Royalty. The first, named Anna Amhoff, is a white variety blooming about two weeks later than ordinary lilacs. The flowers are white when fully opened but have a light pink cast while still in the unopened stage. The second variety, Nellie Bean, a purple variety also blooming two weeks later than common lilacs, has proved very vigorous and productive. Both varieties are excellent landscape plants and make the third of a trio which includes James MacFarlane, a pink variety named several years ago now being propagated by a considerable number of nurseries. Propagating wood of the two new varieties is now available, but it will be some time before the plants are available to the general public.

A. F. Yeager, E. B. Risley

Progress in Breeding Rambler Roses for Cold Climates

Rambler roses of high quality, possessing winter hardiness sufficient to permit survival of the canes without protection throughout all of the northeastern United States, are being developed at the University of New Hampshire Horticulture Farm. Skinners Rambler, a "wild" appearing, single pink flowered rose with twenty foot canes that are hardy in Manitoba, Canada, forms the base for the breeding work. This summer, flowers were seen on 46 of its descendants and it is expected that the majority of 200 more will bloom in 1955. Of those that flowered this year, 4 may prove worthy for distribution and others are being used for further breeding. These 4 include an 85 petal pink, a light yellow, and 2 whites, all doubled flowered and vigorous.

E. B. Risley

Aluminum Foil Appears to Speed Healing of Wounds on Tree Trunks

Open wounds on apple, sour cherry, and plum tree trunks resulting from splitting due to winter injury in the winter of 1949-50 have been wrapped with aluminum foil from September 15 to May 5 of each succeeding year. On May 5, 1954, all wounds on all species and varieties were greatly reduced in size or healed completely. Wounds on trunks of unwrapped trees were nearly their original size and in some instances larger than their original measurement.

R. Eggert

Conserving Soil Moisture

Bark mulch used around young Chestnuts and Blackberries resulted in increased growth of these plants because of increased soil moisture. Orchard grass cut in early June and left where it fell reduced soil water loss by 10 to 12 percent compared to that lost where grass was not cut.

Treeberries, *Rubus morifolnia,* which were supplied extra water in the fall, survived the winter of 1953-54 in excellent condition, while plants of this species which did not receive the extra water were winter killed.

R. Eggert, E. M. Meader, A. F. Yeager

The Testing and Utilization of New Plants

A collection of Physalis (ground cherry) varieties from the U.S.D.A. Bureau of Plant Introduction and elsewhere were grown at the Horticulture Farm in Durham in 1954 and the following data obtained: Gold Nugget, also called Sugar Giant, appears similar to P. I. 197691. It was the most productive of those tested. Some of the fruits reached a diameter of 2 inches, but it has inferior quality. The common ground cherry is early and productive with good quality. The Cape Gooseberry from England is identical to P. I. 193577. It has superior quality but is late. The Apple variety from Hawaii is similar to the common variety but late in maturing. Crosses were made between the most desirable types.

E. M. Meader, A. F. Yeager

Poultry Husbandry

Breeding for Whiter Dominant-White Crossbreeds

Considerable time and money has been spent by poultry breeders in trying to develop a pure white crossbred chick. To help the breeders solve some of their many problems a study was undertaken involving three color factors.

The extended black, barring, and silver genes were studied in various combinations with heterozygous dominant white. Results indicate sex differences in the amount of red removed by extended black and silver. In males, extended black generally does not remove as much red as it does in females. However, the females generally show some black and may also have black shanks. Barring has been found to eliminate the black shanks but not all of the black in the body feathers. There appears to be a sex difference in the action of silver, but more data is needed to determine this point.

The work indicates that silver should probably be present in a domi-

nant white line, while the importance of extended black is questioned. Further data is needed to determine the effect of barring on red, particularly when in combination with silver.

F. L. Cherms, Jr., W. M. Collins

Growth Rate of Durham X New Hampshire Crosses

Three years' results of crossing Durhams with New Hampshires indicates that the crosses grow much more rapidly than pure Durhams and at about the same rate as the Experiment Station New Hampshires. In the 1953 and 1954 New Hampshire 4-H Chicken-of-Tomorrow contests, the growth of Durham crosses compared quite favorably with the growth of several good commercial broiler strains. Crosses of Durhams with the Experiment Station New Hampshires usually have greater breast width than the pure New Hampshires.

Improvement in growth rate within the Durham breed has resulted over the past three years by selecting on a closed flock basis. It is planned to compare the efficiency of the closed flock system with a newer breeding method in selecting for combinability for growth rate and other characters of economic importance.

W. M. Collins, F. L. Cherms, Jr.

Breeds and Strains of Chickens Differ in Amount of Yellow Pigment Present in the Shanks during the Growing Period

It has been known for some time that relatively minor changes in the content of a poultry ration may influence the degree of shank pigmentation in chickens, and such modifications frequently result in changes in the efficiency of the ration. Certain diseases, such as coccidiosis, often effect changes in the color of the shanks to the extent that chickens with pale shanks are often discriminated against by the buyer of live poultry.

Breed, strain, and sex differences in shank pigmentation were observed in a study involving chickens entered in three trials of the 1953 New Hampshire Broiler Test. The study showed that the shanks of New Hampshires were more deeply pigmented than the shanks of White Plymouth Rocks and that certain strains within each breed differed significantly in shank color. It was also observed that the shank color of males was significantly darker than the shank color of females.

In each breed studied, the within-strain variation in shank color appeared to be sufficiently large to enable the interested breeder to successfully select for improvement in this character.

W. M. Collins, S. C. Thayer

Selection of Poultry for Better Feed Utilization Efficiency

For the past two years the feed consumption for maintenance of individual adult males has been measured over a short feeding period. Feed consumption of individual females similar in weight and producing at about the same rate has been measured during a period of comparable length. Selected males and females have been mated, and growth and feed consumption data taken on the offspring, so as to develop two lines of chickens, each differing in feed utilization efficiency for growth.

Some progress was made last year in separating the two lines. Preliminary results this year indicate that the lines remain separated. Since during the growing period efficiency data was obtained on individuals, and since there are superior families in each line, the opportunity for selection within each line is greater this year than last

W. M. Collins, F. L. Cherms, Jr.

Good Poultry Ranges Can Lower Pullet Rearing Costs

Pullets were reared from 10 to 22 weeks of age on range plots, on which the predominant vegetation was ladino clover, in order to determine the extent to which the feeding program might be modified and rearing costs reduced. Full feeding of pullets was compared with scratch grain full fed and with pellets and oats fed on a restricted basis. When compared to pellets full fed, the scratch grain program decreased feed cost per pullet by 24 cents and the restricted feeding program decreased feed cost by 12 cents. Egg production was delayed 11 days in the group fed scratch grain with no difference for the other groups. At the termination of the test at 42 weeks of age, there were only small differences among the groups in egg production, feed consumed, egg size, and body weight. Considering the complete period from 10 to 42 weeks of age, the pullets reared on scratch grain returned 64 cents more per bird above feed cost. There was no difference between the other two groups. It would thus appear that the ladino clover was an important supplement to this minimum grain feeding program.

R. C. Ringrose, R. M. Hatch

Methionine and Methionine Hydroxy Analogue May Improve Broiler Feeds

Currently there is much interest in supplementing starting and broiler feeds with the amino acid methionine. This interest is a result of production of methionine by the chemical industry at a price which warrants consideration of its use.

In three experiments during the year, the value of methionine and methionine hydroxy analogue has been studied. In two of the three experiments growth and/or feed efficiency was improved. The use of either of these amino acids resulted in an increased net return per 1000 broilers raised which ranged between four and twelve dollars.

R. C. Ringrose, W. R. Sanson

Mass Immunization of Chickens against Newcastle Disease and Infectious Bronchitis

Since the introduction of the mass vaccination technique a year ago by the Experiment Station, a considerable amount of work has been conducted here and elsewhere to improve on the techniques available and to develop new approaches.

Field trials have been conducted in New Hampshire on over 5,000,000 birds, using the spray method at various chick age levels. Recently trials with combination dust vaccine have been started and the results are fairly encouraging.

Most of the birds were vaccinated during the first week of life. Those being kept for replacement were revaccinated at 18 weeks. Recently chicks have been vaccinated at all ages to maturity.

It is interesting to note that while a good take was observed in the chicks vaccinated at an early age, the same birds revaccinated at 18 weeks with combination Newcastle and Infectious Bronchitis vaccine by the spray method showed little or no reaction. This conclusion was further borne out by challenge and serological results, thus indicating that the resistance stimulated by the spray technique for Newcastle and Infectious Bronchitis diseases may be present in chicks at 18 weeks of age.

The resistance to Newcastle and Infectious Bronchitis stimulated by such a procedure appeared to carry breeders through the season with no breaks recorded on well over 1,000,000 birds. Further parental immunity for both diseases was quite satisfactory in day-old chicks so vaccinated hatched from breeders.

During the past year, contrary to results of earlier experiments, it has been found that parental immunity to Infectious Bronchitis does not have as much bearing on early chick mass immunization as the Chronic Respiratory Disease Complex present in the chick at times of vaccination. Chronic Respiratory Disease has also been found a complicating factor when birds are vaccinated during the growing period.

Vaccination by means of a dust preparation containing the combination vaccine for Newcastle disease and Infectious Bronchitis has been tried on some 20,000 birds. While serological tests and challenge results are encouraging, further trials will be necessary. Dust vaccination has had insufficient field trials, but it is another means of mass immunization which saves considerable time and labor.

In summarizing the work on this project, it has been demonstrated that mass immunization by the spray technique is an effectual method of controlling Newcastle disease and Infectious Bronchitis in replacement flocks as well as in broilers, thereby emphasizing that mass immunization of birds against Newcastle disease and Infectious Bronchitis is a reality today in the poultry industry.

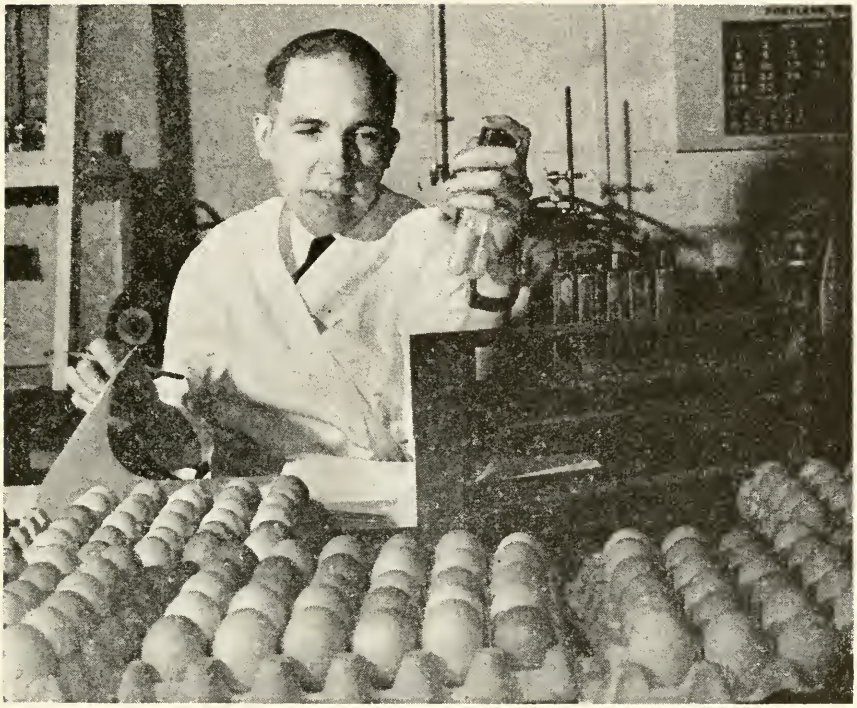
W. R. Dunlop

Early Wing Web Vaccination for the Prevention of Newcastle Disease

In order to determine the feasibility of vaccinating chicks under 4 weeks of age for the prevention of Newcastle disease with wing web vaccine, trials have been conducted utilizing the vaccine at 7 and 14 days of age. Parallel groups of parentally immune and parentally susceptible chicks were used. Each treatment group was run in duplicate.

In the trial when the chicks were vaccinated at 7 days of age, two chicks out of 40 died from the susceptible groups and 5 others were visibly abnormal. None of the parentally immune chicks were visibly affected. Upon challenge with a virulent strain of Newcastle virus at 5 weeks, all chicks remaining of the parentally susceptible groups survived except one runt. In the case of the parentally immune groups, 11 died and 11 showed symptoms upon the 5 week challenge.

In the trial when the chicks were vaccinated at 14 days of age, the experimental design was the same as with the younger chicks. Upon challenge



Examining a laboratory control test on experimental vaccine.

at 5 weeks with a virulent Newcastle virus, all survived except one bird. Serological tests closely paralleled challenge results in both trials.

From the results of these trials, it is evident that there may be considerable question as to the advisability of vaccinating chicks at 7 days of age, particularly from the standpoint of mortality following vaccination and the apparent lack of resistance to Newcastle disease at 5 weeks of age. However, when chicks are vaccinated by the wing web method at 14 days, the mortality is low and the immunity at 5 weeks is good.

W. R. Dunlop

No Detrimental Effect to Chickens from Nitrophenide Fed during Their Entire Period of Growth

From time to time it has been suggested that the feeding of drugs for the control of coccidiosis may interfere with the stimulation of resistance to the disease. It is also suggested that the drugs may have a toxic effect when fed over long periods of time. Some have even suggested that hatchability and fertility may be affected by the prolonged use of drugs.

During the past year an attempt was made to critically evaluate the continuous medication with nitrophenide for 22 weeks versus medication over a 12 week period when subjected to natural exposure of coccidosis. The results of the trials indicate that birds getting a prophylactic level of the drug either for 12 weeks or 22 weeks were not prevented from picking up a sufficient amount of exposure to develop immunity. Furthermore, ad-

ministration of the drug did not affect the production or the hatchability and fertility of the laying flock, thus indicating that under controlled field conditions no detrimental effect could be attributed to the feeding of nitrophenide.

W. R. Dunlop

Conditions Under Which Hatching Eggs Are Held Influence Quality of Chicks

The importance of holding hatching eggs under ideal conditions prior to incubation has been clearly demonstrated by recent trials at the University of New Hampshire Poultry Farms. Hatching eggs have been held from two to fourteen days under ideal conditions in a refrigerated room; under average conditions in an egg holding room, and under poor conditions in a hot, dry room.

In respect to hatchability, the eggs held under refrigeration have averaged 2.7 percent higher hatchability than those held in the egg holding room and 10.9 percent higher than those held in the hot dry room.

At hatching time the chicks were graded. The chicks from eggs held in the egg holding room averaged 10.5 percent poor quality chicks as compared to 15.3 percent for those held in the refrigerator and 18.3 percent for those held in the hot dry room.

W. C. Skoglund

Abnormal (Bulging) Eye in New Hampshires

This unusual bulging eyed condition usually occurs between the fourth and eighth week of age, although in some chickens it occurs much later. The abnormal individuals appear to grow nearly as well as normal chickens, but the few affected females which have thus far been raised to maturity have laid few eggs and produced no offspring.

Because of the limited number of abnormal individuals produced to date, little progress has been made in determining the mode of inheritance. However, over sixty bulging eyed chickens were produced this season.

The characteristic is also being studied histologically.

W. M. Collins, P. A. Wilcox, F. L. Cherms, Jr.

Influence of Light and Humidity upon the Physical Condition of Broilers

In order to determine the influence that light intensity in the pens has upon the physical condition of broilers, experiments were carried out in which chicks growing under conditions of natural sunlight, supplementary artificial light, and darkened pens were compared.

At six weeks of age there was a tendency for the feathering score to improve as light intensity was decreased. However, at market age this advantage is not still apparent and market weight, feed consumption, and feed efficiency are practically identical under all of the various light intensity conditions.

W. C. Skoglund

State Services

Inspection of Fertilizers and Feedingstuffs

During the 1953-54 fiscal year 123 samples of fertilizers and fertilizer materials and 707 samples of feedingstuffs were analyzed, in accordance with state laws regulating the sale of these materials.

Of the 123 samples of fertilizers analyzed, 52 equalled or exceeded the guarantees in all respects. In general, the deficiencies found were small, and manufacturers on the whole did a good job in providing a satisfactory product for the farmers' use. Detailed results of the analyses of these samples are published in Bulletin 405 of the New Hampshire Agricultural Experiment Station.

Of the 707 samples of feedingstuffs analyzed, 667 were ingredients and mixed feeds, and 40 were canned cat and/or dog foods. These samples represented the products of 165 manufacturers. Forty-three brands were sampled two or more times during the year. There were fewer deficiencies found this year than in the past several years and they were generally small. Eight and eight tenths percent of the samples were deficient in protein, 5.2 percent were deficient in fat, and 3.8 percent contained excess crude fiber. Detailed results of the tests were published in Bulletin 412 of the New Hampshire Agricultural Experiment Station.

As a measure of accuracy and effectiveness of the techniques and methods used in the laboratory, two series of check samples were analyzed during the year; one series of 15 samples was supplied by the American Oil Chemists and other 6 samples by the Association of Feed Control Officials. Approximately 100 Experiment Station and industrial laboratories participated in these tests to insure that their work was up to standard.

Collaborative work in the development and improvement of methods for the determination of nitrogen, as a part of the program of the Association of Official Agricultural Chemists, has been continued.

Inquiries received from residents of the state concerning the analyses of silages, feeds, and fertilizers have been answered as received, including 11 which required analytical work.

H. A. Davis

Seed Inspection, 1953-1954

Seed inspection work for the New Hampshire State Department of Agriculture has been conducted for the last 45 years. During the past year, 696 official seed samples were collected by the State Inspectors throughout the State and results of the tests will be reported in Station Bulletin 415. In addition, 1229 private samples were sent in by seed dealers and farmers, making a total of 1925 samples handled by our laboratory.

This past year, 25 samples of seed were sent to 60 official laboratories in the United States and Canada in a program of rating laboratories, and 12 regional referee samples were received. Our laboratory took part in all of this work.

Bessie G. Sanborn

Soil Testing, 1953-1954

During the last fiscal year, residents of the state have submitted 6,358 soil samples for analysis of pH values and available nutrients. This work

entailed 44,506 individual determinations. Twenty-five peat and muck samples submitted for identification, and for possible commercial use were analyzed for moisture and organic matter content and for pH value.

G. P. Percival

Diagnostic Services Performed at the Poultry Laboratory, University of N. H.

From July 1, 1953, to June 30, 1954, a total of 5,965 specimens of all kinds were submitted to the Poultry Laboratory for diagnosis. These represented 2,549 cases.

A total of 5,396 chicken specimens were examined, 147 turkeys, and 10 miscellaneous birds. Twenty-seven cases consisting of 44 specimens from various animals were also handled by the laboratory personnel. There were 368 cases of blood samples submitted for the immunity tests.

A. C. Corbett, W. R. Dunlop

Infectious Bronchitis Virus

The Poultry Laboratory has continued to grow Infectious Bronchitis on embryonating eggs, and after being tested for purity and potency, it is sold to poultrymen of the state for inoculation of their susceptible birds. During the last fiscal year, 989 lots of this virus were supplied to New Hampshire poultrymen. This is used entirely for flock replacements, whereas the U.N.H. experimental combination Newcastle and Bronchitis spray vaccine is used with excellent results for either broilers or flock replacements.

F. E. Allen, A. C. Corbett, W. R. Dunlop

Pullorum Testing

Testing of the poultry for Pullorum disease in the State of New Hampshire is done by the Poultry Laboratory at the University. During the fiscal year, 1,528,170 birds were tested by means of the tube agglutination test. In addition, 64, 893 retests were made, thus giving a total of 1,593,063 samples tested for the year.

Of 497 flocks tested, infection was found in 6. Thus 1.2 percent of the flocks under test were infected.

F. E. Allen, A. C. Corbett, W. R. Dunlop

New Hampshire Agricultural Experiment Station Staff

June 30, 1954

Administration

HAROLD C. GRINNELL, PH.D., Director
MATHIAS C. RICHARDS, PH.D.. Associate Director
RUSSELL C. SMITH, B.A., Purchasing Assistant
NORMAN MYERS, B.A., Assistant Treasurer
L. FRANKLIN HEALD, B.A., Editor
HENRY W. CORROW, JR., B.S., Assoc. Editor for Agr. and Home Economics
THELMA BRACKETT, A.B., Librarian
CYNTHIA LOVEJOY, A.B., Librarian of Plant and Animal Sciences Library
MAISIE C. BURPEE, Secretary
THERESA R. BATCHELDER, Mail Clerk

Agricultural and Biological Chemistry

ARTHUR E. TEERI, PH.D., Associate Chemist
THOMAS G. PHILLIPS, PH.D., Chemist
STANLEY R. SHIMER, M.S., Associate Chemist
GORDON P. PERCIVAL, M.S., Associate Chemist
HENRY A. DAVIS, M.S., Assistant Chemist
WARREN AVERILL, PH.D., Assistant Chemist
MARGARET LOUGHLIN, M.S., Research Assistant in Agricultural and Biological Chemistry
DOROTHY JOSSELYN, Assistant
VESTA STAAB, B.S., Assistant

Agricultural Economics

WILLIAM F. HENRY, M.S., Agricultural Economist
WILFRED K. BURKETT, PH.D., Associate Agricultural Economist
JAMES R. BOWRING, PH.D., Associate Agricultural Economist
LAWRENCE A. DOUGHERTY, B.S., Assistant Agricultural Economist
GEORGE FRICK, M.S., B.A.E. Cooperator
JOSEPH GARTNER, B.S., Graduate Research Assistant

Agricultural Engineering

ROBERT S. PALMER, B.S.A.E., Assistant Agricultural Engineer

Agronomy

ROY L. DONAHUE, PH.D., Agronomist
*FORD S. PRINCE, B.S., Agronomist
LEROY J. HIGGINS, B.S., Associate Agronomist
LOUIS T. KARDOS, PH.D., Associate Agronomist
PAUL T. BLOOD, M.S., Assistant Agronomist
GERALD M. DUNN, PH.D., Assistant Agronomist
SCOTT A. MILLER, PH.D., Assistant Agronomist
BESSIE G. SANBORN, Seed Analyst
WALTER LYFORD, M.S., Soil Surveyor
DONALD A. EMERY, B.S., Graduate Research Assistant
RICHARD E. THOMAS, B.S., Graduate Research Assistant
MARTIN A. TOWNSEND, B.S., Graduate Research Assistant

Animal Husbandry

*G. L. SMITH, M.S., Assistant Animal Husbandman

---

*On leave of absence.

Bacteriology

Lawrence W. Slanetz, ph.d., Bacteriologist
Edward Katz, ph.d., Assistant Bacteriologist
Fred E. Allen d.v.m., Veterinarian
Agnes T. Richardson, b.s., Laboratory Assistant
Norman W. Chmura, b.s., Graduate Research Assistant
Garrett Keefer, b.a., Graduate Research Assistant
Joseph Marelli, Departmental Technician

Botany

Albion R. Hodgdon, ph.d., Plant Taxonomist
Stuart Dunn, ph.d., Plant Physiologist
Charlotte G. Nast, ph.d., Associate Cytologist
Avery Rich, ph.d., Plant Pathologist
James D. Bilbruck, b.s., Graduate Research Assistant
Harvey Toko, b.s., Graduate Research Assistant
Judith Dorr, b.s., Graduate Research Assistant

Dairy

Kenneth S. Morrow, m.s., Dairy Husbandman
Harry Keener, ph.d., Dairy Husbandman
Herbert C. Moore, m.s., Associate Dairy Husbandman
Nicholas F. Colovos, m.s., Associate Animal Nutritionist
C. H. Boynton, m.s., Associate Dairy Husbandman
A. D. Littlehale, Herdsman
Barbara Sanders, b.s., Research Assistant

Entomology

James G. Conklin, ph.d., Entomologist
Robert L. Blickle, ph.d., Associate Entomologist
Wallace J. Morse, b.s., Research Assistant in Entomology

Forestry

Clark L. Stevens, ph.d., Forester
Lewis C. Swain, m.f., Associate Forester
Bertram Husch, ph.d., Assistant Forester
Oliver Wallace, ph.d., Assistant Forester

Home Economics

Anna M. Light, ph.d., Home Economist

Horticulture

Albert F. Yeager, ph.d., Horticulturist
L. Phelps Latimer, ph.d., Associate Horticulturist
Elwyn M. Meader, m.s., Associate Horticulturist
William W. Smith, ph.d., Associate Horticulturist
Russell Eggert, m.s., Associate Horticulturist
Edward B. Risley, b.s., Assistant Horticulturist
Radcliffe Pike, m.s., Collaborator
Shih-an-Yu, b.s., Graduate Research Assistant

Poultry

Winthrop C. Skoglund, m.s., Poultry Husbandman
Richard C. Ringrose, ph.d., Poultry Nutritionist
Fred E. Allen, d.v.m., Veterinarian
Alan C. Corbett, d.m., Pathologist
William R. Dunlop, d.v.m., Research Pathologist
Walter M. Collins, m.s., Poultry Geneticist
Frank L. Cherms, Jr., b.s., Graduate Research Assistant

Richard M. Hatch, b.s., Graduate Research Assistant
Richard G. Strout, b.s., Graduate Research Assistant
Robert E. Leventhal, b.s., Graduate Research Assistant
William R. Sanson, b.s., Graduate Research Assistant
E. T. Bardwell, b.s., R.O.P. Supervisor
C. F. Zoerb, Poultry Inspector
Donald E. Coller, b.a., Senior Laboratory Technician
Donald S. Cross, Senior Laboratory Technician
Kathryn Moore, Assistant Laboratory Technician
Emily Donovan, Assistant Laboratory Technician
Harriet Fogg, Assistant Laboratory Technician

CHANGES IN PERSONNEL

Additions to Staff

Carey, Winifred A., Laboratory Technician in Poultry Husbandry (July 1, 1953-February 5, 1954)
Chmura, Norman W., Graduate Research Assistant in Bacteriology (September 1, 1953-)
Coller, Donald E., Senior Laboratory Technician in Poultry Husbandry (July 1, 1953-)
Corrow, Henry W., Jr., Associate Editor for Agriculture and Home Economics (July 1, 1953-)
Dorr, Judith, Graduate Research Assistant in Botany (September 1, 1953-)
Emery, Donald A., Graduate Research Assistant in Agronomy (July 1, 1953-)
Fogg, Harriet, Assistant Laboratory Technician in Poultry Husbandry (December 1, 1953-)
Gartner, Joseph, Graduate Research Assistant in Agricultural Economics (February 1, 1954-)
Hobby, Barbara Dustin, Laboratory Technician in Agricultural & Biological Chemistry (September 15, 1953-May 31, 1954)
Light, Anna M., Home Economist (July 1, 1953-)
Lockhardt, Esther E., Library Assistant, Plant and Animal Sciences Library (January 28, 1954-February 28, 1954)
Lovejoy, Cynthia, Librarian, Plant and Animal Sciences Library (June 1, 1954-)
Miller, Scott A., Assistant Agronomist (July 1, 1953-)
Palmer, Robert S., Assistant Agricultural Engineer (July 1, 1953-)
Sanders, Barbara, Research Assistant in Dairy Husbandry (July 1, 1953-)
Sanson, William R., Graduate Research Assistant in Poultry Husbandry (August 24, 1953-)
Shih-an-Yu, Graduate Research Assistant in Horticulture (May 1, 1954-)
Townsend, Martin A., Graduate Research Assistant in Agronomy (August 17, 1953-)
Wallace, Oliver P., Assistant Forester (September 1, 1953-)

Losses from Staff

Baker, John R., Graduate Research Assistant in Botany (September 1, 1951- August 31, 1953)
Bertram, Robert E. J., Jr., Graduate Research Assistant in Horticulture (September 21, 1953-January 31, 1954)
Bilbruck, James D., Graduate Research Assistant in Botany (July 1, 1952-June 30, 1954)
Carey, Winifred A., Laboratory Technician in Poultry Husbandry (July 1, 1953-February 5, 1954)
Davis, Marvin, Laboratory Technician in Poultry Husbandry (September 1, 1952-June 15, 1954)
Hatch, Richard M., Graduate Research Assistant in Poultry Husbandry (July 1, 1952-June 30, 1954)
Hobby, Barbara Dustin, Laboratory Technician in Agricultural and Biological Chemistry (September 15, 1953-May 31, 1954)
Kardos, Louis T., Associate Agronomist (June 1, 1943-June 30, 1954)
Katz, Edward, Assistant Bacteriologist (July 1, 1951-June 30, 1954)

Keefer, Garrett, Graduate Research Assistant in Bacteriology (February 1, 1953-June 30, 1954)

Leventhal, Robert E., Graduate Research Assistant in Poultry Husbandry (April 1, 1953-June 30, 1954)

Lockhardt, Esther E., Library Assistant, Plant and Animal Science Library (January 28, 1954-February 28, 1954)

Payne, Putnam, Research Assistant in Horticulture (September 1, 1951-August 31, 1953)

Pelletier, Raymond, Graduate Research Assistant in Bacteriology (July 1, 1952-August 31, 1953)

Poulin, Roger J., Library Assistant in Charge of Plant & Animal Sciences Library (July 1, 1951-January 15, 1954)

Strout, Richard G., Graduate Research Assistant in Poultry Husbandry (August 15, 1952-June 30, 1954)

Thomas, Richard, Graduate Research Assistant in Agronomy (July 1, 1952-June 30, 1954)

Toko, Harvey, Graduate Research Assistant in Botany (February 1, 1953-June 30, 1954)

Woodworth, Harry C., Agricultural Economist (Deceased September 18, 1953)

Publications

Experiment Station Bulletins

403 *Inspection of Commercial Feedingstuffs.* H. A. Davis and V. F. Staab.

404 *Results of Seed Tests for 1953.* Bessie G. Sanborn.

405 *Inspection of Commercial Fertilizers.* H. A. Davis and V. F. Staab.

407 *Production Efficiency on New England Farms. IV. Adjustments in the Organization of Machinery and Equipment.* G. E. Frick, S. B. Weeks, and I. F. Fellows.

408 *Economical Tree Killing.* L. C. Swain.

409 *Report of the Director of the New Hampshire Agricultural Experiment Station.* H. C. Grinnell and M. C. Richards.

410 *Tank-Truck Assembly of Milk for New Hampshire.* J. R. Bowring.

411 *Cobalt Deficiency in New Hampshire Cattle, Sheep, and Goats.* H. A. Keener, G. P. Percival, K. S. Morrow.

Scientific Contributions

145 Teeri, A. E. *A New Fluorometric Determination of Thiamine.* Jour. Biol. Chem. *196*: 547-550. 1952.

146 Meader, E. M. *Accelerated Increase of High-Bush Blueberry by Forced Softwood Cuttings.* Proc. Amer. Soc. Hort. Sci. *60*: 97-100. 1952.

157 Keener, H. A., and A. E. Teeri. *Metabolic Fate of S^{35} in the Lactating Cow When Fed $S^{35}O^2$ Preserved Silage.* Jour. Dairy Sci. *36*: 1205-1211. 1953.

158 Teeri, A. E., and D. Josselyn. *Effect of Excess Amino Acids on Growth of Certain Lactobacilli.* Jour. Bact. *66*: 72-73. 1953.

160 Teeri, A. E. *Colorimetric Determination of Blood Calcium with Chloranilic Acid.* Chemist. Analyst. *43*: 18-21. 1954.

165 Meader, E. M., W. W. Smith, and A. F. Yeager. *Bush Types and Fruit Colors in Hybrids of Highbush and Lowbush Blueberries.* Proc. Amer. Soc. Hort. Sci. *63*: 272-278. 1954.

Research Mimeographs

Agricultural Economics

12 Burkett, W. K. *Costs of Different Machine and Labor Methods in Potato Production.*

Forestry

1 Husch, B. *Preliminary Site Index Table for White Pine in Southeastern New Hampshire.*

Expenditures for the Fiscal Year Ending June 30, 1954

	Hatch	Adams	Purnell	Bankhead-Jones Section 5	Bankhead-Jones 9b 1-2	Bankhead-Jones 9b 3	Supplementing
Personal Services	$14,264.98	$14,890.67	$56,044.20	$10,968.43	$32,664.76	$ 5,859.60	$81,828.98
Travel	46.05		85.10	80.55	4.26	1,094.70	5,196.86
Transportation of Things	10.63		102.69	6.30		21.71	847.10
Communication Service			4.00			35.12	936.26
Rents and Utility Services							956.40
Printing, etc.						5.60	2,448.63
Other Contractual Services	56.50		777.11			1,911.21	750.96
Supplies and Materials	567.75	109.33	2,577.03	242.69	299.53	4,367.89	56,936.49
Equipment	54.09		409.87	65.46	254.22	1,604.17	10,940.20
Totals	$15,000.00	$15,000.00	$60,000.00	$11,363.43	$33,222.77	$14,900.00	$160,841.88

Income for Supplementary Expenditures	
State Money Offsetting Federal Funds	$ 44,586.20
State Money for Station	82,506.79
Research Sales	10,401.99
Other Income (Mostly from Private Grants)	23,346.90
	$160,841.88